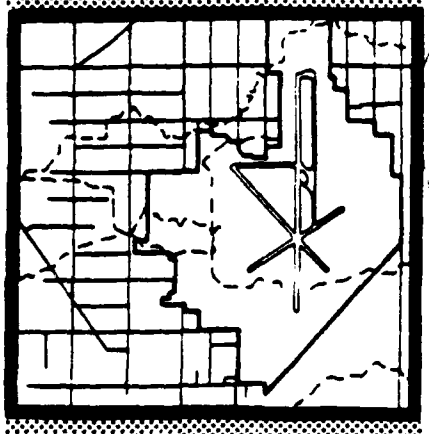

INSTALLATION RESTORATION PROGRAM
STAGE 3
McCLELLAN AIR FORCE BASE

PREPARED BY:
Radian Corporation
10395 Old Placerville Road
Sacramento, California 95827

JANUARY 1989

HEALTH AND SAFETY PLAN

FINAL COPY

PREPARED FOR:
HEADQUARTERS AFLC/DEV
WRIGHT-PATTERSON AFB, OHIO 45433

United States Air Force
Occupational and Environmental Health Laboratory (USAFOEHL)
Technical Services Division (TS)
Brooks Air Force Base, Texas 78235-5501

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INSTALLATION RESTORATION PROGRAM
STAGE 3
McCLELLAN AIR FORCE BASE, CALIFORNIA

HEALTH AND SAFETY PLAN

FINAL

HEADQUARTERS AFLC/DEV
WRIGHT-PATTERSON AFB, OHIO 45433

January 1989

Prepared by:

Radian Corporation
10395 Old Placerville Road
Sacramento, California 95827

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USAFOEHL TECHNICAL PROGRAM MANAGER
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UNITED STATES AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
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NOTICE

This report has been prepared for the United States Air Force by Radian Corporation for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP). As the report relates to actual or possible releases of potentially hazardous substances, its release prior to an Air Force final decision on remedial action may be in the public's interest. The limited objectives of this report and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report, since subsequent facts may become known which may make this report premature or inaccurate. Acceptance of this report in performance of the contract under which it is prepared does not mean that the U.S. Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

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This document contains the Health and Safety Plan to protect the health and safety of workers conducting currently anticipated aspects of Remedial Investigation/Feasibility Study (RI/FS) work tasks at McClellan AFB. This Health and Safety Plan is designed to ensure that all work tasks associated with the RI/FS are completed in a safe manner and in accordance to the Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations 1910.120.

This plan is written based on the guidelines outlined in the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (October 1985) prepared as a joint effort by the National Institute of Occupational Safety and Health, OSHA, the U.S. Environmental Protection Agency, and the U.S. Coast Guard and in accordance with OSHA Standards for General Industry, 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response.

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PREFACE

Radian Corporation is the contractor for the RI/FS program at McClellan AFB, California. This work was performed for the USAF Occupational and Environmental Health Laboratory (USAFOEHL) under USAF Contract No. F33615-87-D-4023, Delivery Order 0006.

This Health and Safety Plan was developed to assure that Remedial Investigation work is performed in a safe manner and in accordance with proper measure to protect the health of the workers involved. This plan covers field work for the currently envisioned tasks with provision for modification for and future activities not covered.

Key Radian project personnel were:

Nelson Lund - Contract Program Manager
Jack D. Gouge' - Delivery Order Manager
Clive Mecham - Waste Management & Health
Rory Morgan - Health & Safety Engineer

The work presented herein was accomplished between November 1987 and December 1988. 1st Lt. Jerald Styles, Technical Services Division, USAFOEHL is the Techncial Program Manager.

Approved: _____ _____
Nelson H. Lund Clive Mecham, C.I.H.

_____
Rory W. Morgan

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1.0 INTRODUCTION

The long-range objectives of the McClellan AFB Remedial Investigation/Feasibility Study (RI/FS) are to assess the extent and magnitude of contamination from past hazardous waste disposal and spill sites, and to develop remedies consistent with the National Oil and Hazardous Substances Contingency Plan (NCP) for those sites that pose a threat to human health or welfare, or the environment. This Health and Safety Plan is designed to ensure that all work tasks associated with the RI/FS are completed in a safe manner and in accordance to the Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120, Interim Final Standard for Hazardous Waste Operations and Emergency Response (51FR45675, December 19, 1986).

This Health and Safety Plan outlines the basis of a safety program designed to protect the health and safety of workers conducting all aspects of RI/FS work tasks at McClellan AFB. All Radian employees and its subcontractors will follow this plan. Variances will be cleared through the Radian Project Safety Officer, Rory W. Morgan, prior to implementation.

This plan is written based on the guidelines outlined in the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (October 1985) prepared as a joint effort by the National Institute of Occupational Safety and Health (NIOSH), OSHA, the U.S. Environmental Protection Agency (EPA), and the U.S. Coast Guard and in accordance with OSHA Standards for General Industry, 29 CFR 1910.120, Interim Final Standard Hazardous Waste Operations and Emergency Response. The plan is designed to address general health and safety issues associated with the overall implementation of identified RI/FS work tasks. When more specific work activities are identified that warrant special or unique health and safety procedures, Health and Safety Plan Addendums will be written and incorporated into this McClellan Health and Safety Plan. The Radian Project Safety Officer will make the final assessment of the need for an addendum and will write Health and

Safety Plan Addendums for specific work activities. Addendums will serve to expand health and safety coverage of specific actions not covered in Section 1.1.

The continuation of Section 1 identifies the activities that will occur during the McClellan AFB RI/FS and the responsibility of the individuals conducting those activities. Section 2 describes the site history and description of McClellan AFB that led up to the requirement for establishing the McClellan RI/FS. Section 3 characterizes the contaminants that have been identified at McClellan AFB from past groundwater and soil sampling efforts. Section 4 evaluates the physical and chemical hazards associated with the activities performed at McClellan AFB as outlined in Section 1 and the contaminants identified in Section 3. Sections 5 and 6 identify the procedure that will be followed, via the monitoring program and the chlorinated hydrocarbon hazard criteria, to establish what protective equipment will be required. Section 7 presents these protective equipment requirements in carrying out the various work activities at McClellan AFB. Section 8 outlines the site control and work zones that will be established during all work activities at McClellan AFB. Employee training, medical considerations, and emergency response plans are outlined in Sections 9, 10, and 11; and all necessary records cited in these three sections are presented in Section 12.

1.1 RI/FS Activities

The Health and Safety Plan is written to support field investigation activities which include: pathway characterization, hydrogeological assessment, and base-wide site characterization. Individual tasks associated with the previous mentioned activities include: anticipated geophysical logging; groundwater, surface water, soil, soil-vapor, and air sampling; well drilling and installation; and cuttings disposal and site management (including permits, work logistics, access, disposal of cuttings, etc.). Groundwater sampling and analysis activities are addressed in Addendum 1 of this Health and Safety Plan. Addendum 1 was written in 1985 and has been in use for quarterly monitoring well sampling since that time. Addendum 1 will continue to be used for groundwater sampling activities.

1.2 Responsibilities

The prime responsibility for employee safety will rest with: (1) Radian for its own employees; (2) Radian's subcontractors for their employees; and (3) with other parties whose employees will work under Radian's technical direction. All parties participating in on-site work will comply with all requirements set forth in this Health and Safety Plan. Addendums shall be developed and attached to this plan for specific work activities not covered in Section 1.1. As the remedial investigation develops, Health and Safety Addendums shall be incorporated into this plan and complied with as stated above. Radian, its subcontractors, and other parties participating in on-site work also will comply with all applicable requirements of the Occupational Safety and Health Administration Code, specifically 29 CFR 1910.120.

1.2.1 Key Personnel

The Radian project team organization, presented in Figure 1-1, consists of administrative and technical personnel with experience in the areas pertinent to the RI.

Radian and subcontractor personnel who will have overall responsibility for the safe operation of this project are:

- Project Manager: Morey Lewis, Radian
- Project Safety Officer: Rory W. Morgan, Radian
- On-Site Safety Officer: Barbara St. Germain
- Field Task Leaders:

  Ambient Air Monitoring, Soil Vapor & Soil Sampling: John Clark, Radian;
  Surface Water & Sediment Sampling: Mike Boulay, Radian;
  Well Drilling & Installation: Art Morrill, Radian;
  Groundwater Sampling: Tyler Thompson, Radian.

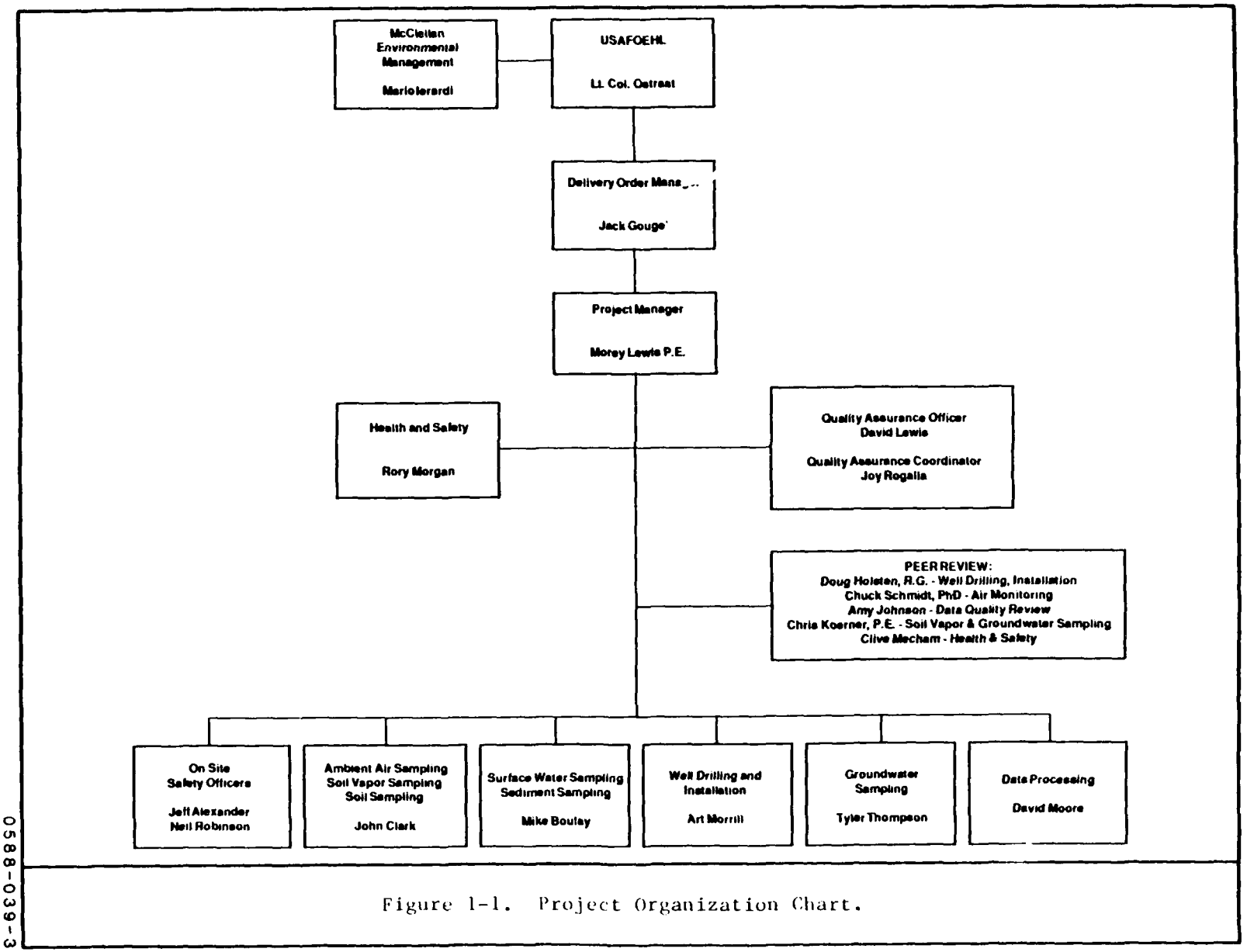

Figure 1-1. Project Organization Chart.

Final selection of subcontractors for drilling and waste transport/disposal has not yet been made. Therefore, key safety personnel with these firms cannot be identified at this time. All non-supervisory personnel employed by Radian or its subcontractors will be responsible for immediately expressing to a supervisor their concerns relating to health and safety. The On-Site Safety Officer will report to the Project Safety Officer who will have overall authority for implementing changes and implementation of this Health and Safety Plan.

1.2.2 Project Safety Officer Responsibilities

The responsibilities of the Project Safety Officer, Rory W. Morgan, with respect to safety, are:

- Initiate contact with McClellan's Safety Officer, Ron Gamber and test the emergency phone numbers to ensure their accuracy (see page 12-3 for emergency telephone numbers);
- Implement the site safety training program as described in this plan;
- Maintain the Health and Safety Program File in the Project File at the Radian Corporation office;
- Develop and write Health and Safety Addendums;
- Approve any changes or modifications to this plan; and
- Review and confirm with the On-Site Safety Officer any changes in personal protective clothing or respiratory protection requirements.

1.2.3 On-Site Safety Officer Responsibilities

The On-Site Safety Officer's responsibility, with respect to safety, are:

- Conduct and document daily Health and Safety Meetings in the On-Site Training Log of the safe work practices that will be performed in accordance with the scheduled activities;
- Observe site activities to ensure the proper use of air monitoring instrumentation and availability of applicable personal protective equipment;
- Establish and ensure compliance with site control areas and procedures; and
- Perform on-site monitoring activities, e.g., heat stress, airborne volatile organics and noise monitoring.

1.2.4 Field Task Leader Responsibilities

The responsibilities of the Field Task Leaders with respect to safety are:

- Locate support facilities in an area removed from the potential contaminated areas and sites of soil disturbance;
- Coordinate activities with the Environmental Management to brief building monitors when working near their buildings;
- Ensure that work schedules, dependent on work levels and outside temperatures, are set each day and adhered to throughout the day;

- Initiate outside emergency phone calls when injuries or accidents require medical attention (see page 12-3 for emergency telephone numbers);

- Ensure that the field teams observe safe work practices and performs daily activities in accordance with this Health and Safety Plan;

- Ensure that safety equipment is maintained properly;

- Report violations and compliance problems to the Radian Project Safety Officer; and

- Conduct and document daily Health and Safety meetings in the On-Site Training Log of the safe work practices that will be performed in accordance with the scheduled activities.

1.2.5 Subcontractor Responsibilities

The responsibilities of the Subcontractor Supervisor, with respect to safety, are:

- Ensure crew compliance with this Health and Safety Plan; and

- Enforce corrective action under the direction of the Radian Project Manager and/or Project Safety Officer. Compliance problems and safety concerns will be brought to the attention of the Subcontractor Supervisor, who will be expected to correct the safety problems immediately and respond to the Radian Project Manager and/or Project Safety Officer regarding such corrections.

1.2.6 Field Team Responsibilities

The responsibilities of the field team members are:

- Read, understand, and sign the Health and Safety Certification form in this plan;
- Perform work safely;
- Report any unsafe conditions to their immediate supervisors; and
- Be aware and alert for signs and symptoms of exposure to site contaminants and/or heat stress.

2.0 GENERAL SITE INFORMATION

2.1 Site History/Description

McClellan Air Force Base (AFB) covers 3,745 acres within irregularly configured boundaries approximately 7 miles northeast of downtown, Sacramento, California's capitol city. McClellan lies within Sacramento County, adjacent to city limits to the west and southwest and bounded by the unincorporated areas of Rio Linda/Elverta to the northwest and North Highlands to the east.

Most of the land surrounding McClellan is low-density residential. The closest residences lie just outside base boundaries in three directions (the area immediately south of the base is primarily commercial/industrial). Twenty schools are located within about 1.5 miles of the base. Parks in the vicinity include the golf course known as Del Paso Park due south of the base and Rio Linda Park, about 1.5 miles to the west. Figure 2-1 shows the base in relation to its neighboring communities.

McClellan served as a bomber depot during World War II, switching to a jet fighter maintenance depot in the early 1950s. Today McClellan operates as an Air Force Logistics Command Center. It employs approximately 23,000 military and civilian personnel for operations that relate to the management, maintenance, and repair of various aircraft and electronics and communications equipment. Specifically, under the Sacramento Air Logistics Center is the Air Force's Technology Repair Center for hydraulics, flight control accessories, ground communications, and electronic components.

Due to its primary mission to militarily defend the United States through the operation and maintenance of aircraft, the Air Force has long been engaged in a variety of operations that require the use of toxic and hazardous materials. Some of the hazardous materials that have been used on the base include: industrial solvents and caustic cleaners, metals from electroplating waste, oils contaminated with polychlorinated biphenyls (PCBs), contaminated jet fuels, low-level radioactive wastes, and a variety of oils and lubricants.

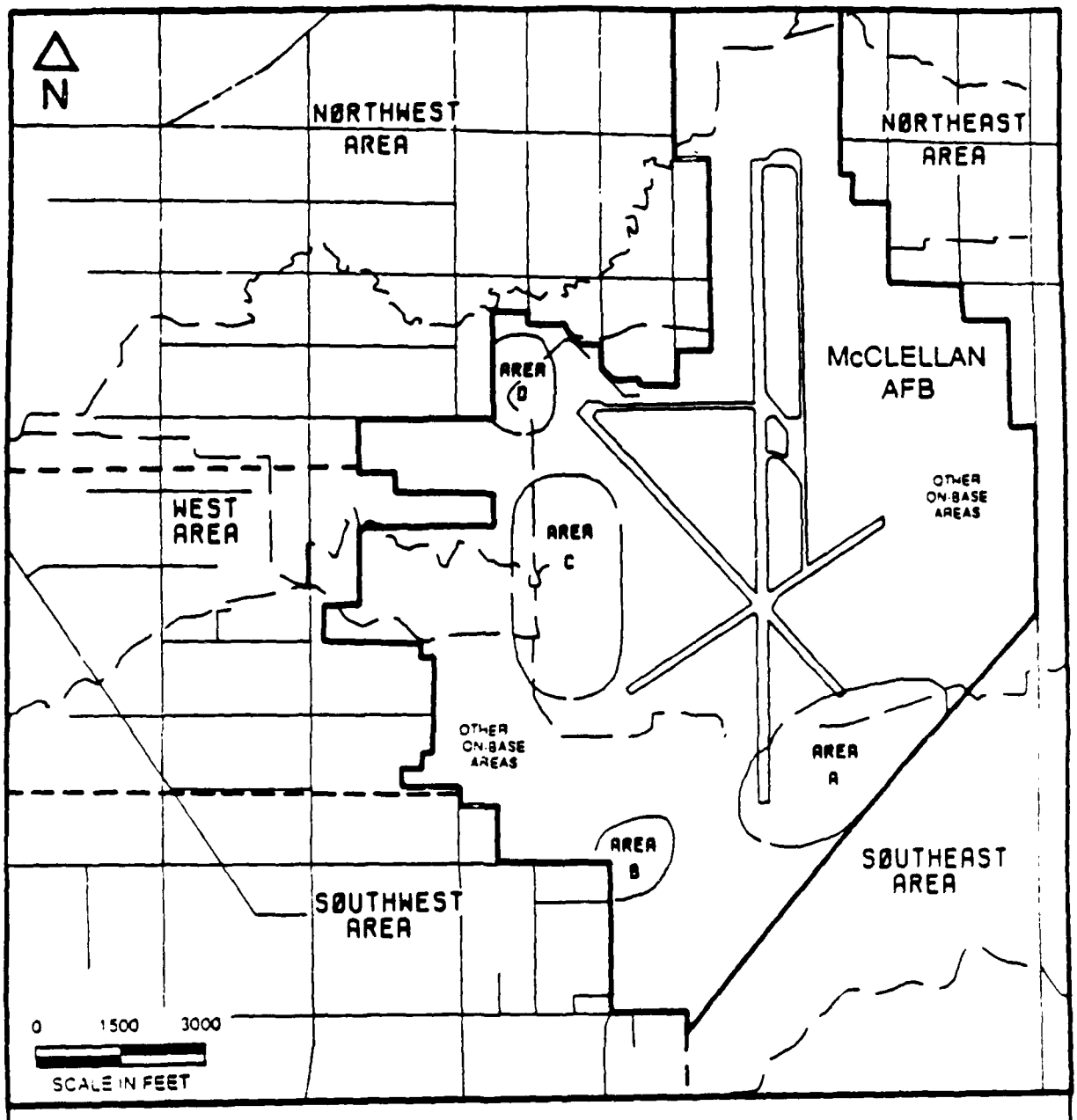

Figure 2-1. Geographical Designations of the Study Area, McClellan AFB

Historically, most of these wastes were buried in pits along the western edge of the facility. Today, these wastes are either placed in drums and transported to an approved Class I disposal site off base or discharged into the base's Industrial Wastewater Treatment Plant (IWTP). Sludge from the IWTP also is transported to an approved Class I disposal site.

McClellan AFB has, in the past, disposed of its waste in a variety of ways from burial pits (refuse, demolition material, excess military equipment, chemicals, etc.), sludge/oil pits, burn pits (refuse, oil, chemicals, etc.), to landfills. Industrial waste sludge also was disposed of on base at the Class II-I site approved by the Central Valley Regional Water Quality Control Board. This practice has since been eliminated. The industrial waste sludge was known to contain high concentrations of tetrachloroethylene (PCE), trichloroethylene (TCE), chloroform, and 1,1,2-trichloro-2,2,1-trifluoroethane. These types of materials also may have been disposed of in the sludge/oil pits.

During the 1940s, TCE and other solvents were dumped into pits and burned. In the 1950s and early 1960s, the base tried to distill TCE and reuse the chemical on base. This proved unsuccessful and significant amounts of TCE wastes continued to be disposed of in the burn pits. TCE use continued until the late 1970s, when it was phased out because of air pollution concerns. Other cleaning solvents were substituted for TCE. In 1976, McClellan began disposing of all of these wastes at off-base state-approved landfills or reclamation processes.

In late 1978, TCE use on base was banned. In 1981, McClellan stopped disposing industrial wastewater sludge on base. After 1981, McClellan limited on-base disposal to small amounts of demolition debris, sewage grit, and treated industrial wastewater.

In 1979, base officials began to suspect that these past disposal practices could be harming the groundwater. A study conducted at the end of that year disclosed that at least four areas of groundwater contamination

generated on base needed to be explored in more depth. These four areas are shown on Figure 2-1 and are identified as Areas A, B, C, and D.

Area A. Area A, in the southeast portion of the base, is where Base Wells 1, 2, and 12 were closed due to TCE contamination.

Area B. Located in the southwest portion of the base, Area B is where low levels of TCE have been found in Base Well 18. It is close to the area where a private well and City Well 150 were closed in 1979 due to TCE contamination.

Area C. In the western portion of the base, Area C includes numerous past disposal sites.

Area D. Located in the northwest portion of the base, Area D includes the past sludge/oil disposal pit sites. Area D also is near the off-base area where several private wells were closed due to TCE contamination.

Today McClellan has identified and investigated 68 potential waste sites, and identified 86 additional potential sites that warrant investigation. Appendix A lists the 68 investigated wastes sites in Table A-1 and the 86 identified additional waste sites in Table A-2. Major cleanup activities to date include construction of a clay cap over Area D to prevent percolation, installation of a groundwater extraction and a treatment system in Area C, installation of over 100 monitoring wells on and off base, and identification of further programs to remediate all contamination-posing threats to human health or the environment.

Acknowledging the multitude of waste disposal activities on base over the years, McClellan in its entirety was recommended for the National Priority List of hazardous waste sites, making it eligible for remedial action under the Federal Superfund program. As a federal facility, McClellan AFB is taking the lead in instituting the RI/FS.

3.0 CONTAMINANT CHARACTERIZATION

This section describes health and safety hazards that may be encountered due to site conditions and the presence of hazardous materials detected in groundwater and soil samples.

3.1 Summary of Materials On Site

Extensive data have been gathered during groundwater and soil sampling and analysis efforts especially over the past two years (1985 to 1987). Compounds detected from the groundwater and soil sampling and analysis efforts are listed in Table 3-1.

3.2 Groundwater Sampling Data of Specific Compounds

The highest concentrations of specific compounds above the California Department of Health Services (DOHS) action levels, and where applicable, U.S. EPA Primary Maximum Contaminant Levels (PMCLs), detected during groundwater monitoring at McClellan AFB from June 1985 to December 1987 are presented in Table 3-2. These results represent only a small percentage of the total sample pool taken during this period. The majority of the groundwater samples contained contamination levels for the specific compounds below 1000 ug/L. Also important to note is that Area D was the location where the majority of these groundwater samples containing the highest concentrations above the action level were taken.

3.3 Soil Sampling Data of Specific Compounds

The highest concentrations of specific compounds detected by soil samples taken at McClellan AFB from October 1984 through July 1986 are presented in Table 3-3. These samples represent the compounds detected most frequently and at highest concentration levels from soil sampling. As mentioned in Section 3.2 with the groundwater samples, these results represent only a small percentage of the total sample pool taken during this period.

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TABLE 3-1. HAZARDOUS COMPOUNDS PRESENT AT McCLELLAN AFB, BASED ON HISTORICAL GROUNDWATER AND SOIL SAMPLING RESULTS FROM 1985-1987

A. Volatile Organics

Benzene	Chlorobenzene
Ethylbenzene	Methyl ethyl ketone (MEK)
1,1,2,2-Tetrachloroethane	Tetrachloroethene (PCE)
1,1,1-Trichloroethane (TCA)	Trichloroethene (TCE)
Toluene	Xylenes
Styrene	Chloroform
1,1-Dichloroethene	Dichloromethane
trans-1,2-Dichloroethene	1,1-Dichloroethane
1,2-Dichloroethane	Vinyl chloride

B. Base/Neutral Extractable Organics

Acenaphthene	Nitrobenzene
bis(2-ethylhexyl)phthalate	Hexachlorobutadine
1,3-Dichlorobenzene	Acenaphthylene
Benzo(a)pyrene	Benzo(a)anthracene
Pyrene	Benzo(g,h,i)perylene
Phenanthrene	Chrysene
Anthracene	1,2-Dichlorobenzene
Benzo(k)fluoranthene	1,4-Dichlorobenzene
Di-n-butylphthalate	Fluorene
Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene
3,3-Dichlorobenzidine	n-Nitrosodimethylamine
Hexachloroethane	Polynuclear Aromatic Hydrocarbons

C. Acid Extractable Organics

2,4-Dimethylphenol	2,4,5-Trichlorophenol

D. Pesticides, Herbicides, and Polychlorinated Biphenyls (PCBs)

Arochlor 1254	Chlorodane

E. Metals

Beryllium	Cadmium
Chromium	Copper
Lead	Mercury
Nickel	Zinc

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TABLE 3-2. HIGHEST CONCENTRATIONS OF SPECIFIC COMPOUNDS DETECTED IN GROUNDWATER AT McCLELLAN AFB, 6/85 THROUGH 12/87

Compound	Well Number	Area	Date	Concentration (ug/L)	DOHS Action Level (ug/L)
Benzene	EW-84	D	10/24/87	26 BL	0.7
Chromium	MW-12	D	10/23/87	80	50[a]
1,1-Dichloroethene	MW-11	D	10/27/87	40,000	6
1,2-Dichloroethane	MW-10	D	10/26/87	330	1
Dichloromethane	MW-11	D	10/27/87[b]	1,700	40
Lead	MW-1012	NE	11-12/85[b]	240	50[a]
Tetrachloroethene	EW-73	D	11/03/87	120 C	4
Toluene	EW-73	D	10/24/87	790	100
1,1,1-Trichloroethane	MW-11	D	10/28/87	10,000	200
Trichloroethene	MW-335	C	7-8/87[b]	52,000	5
Vinyl Chloride	EW-73	D	12/02/87	2,700 C	2

[a] 50 ug/L is a U.S. EPA Primary Maximum Contaminant Level; DOHS has not established action levels for inorganics.

[b] These results indicate a two-month sampling period.

BL = Compound also detected in laboratory blank.

C = Presence of compound confirmed by second column.

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TABLE 3-3. HIGHEST CONCENTRATIONS OF SPECIFIC COMPOUNDS DETECTED IN SOIL SAMPLES AT McCLELLAN AFB, 10/84 THROUGH 9/86

Compound	Area	Concentration (ug/kg)
Benzene	A	4,100
Chromium	D	31,000[a]
1,1-Dichloroethene	D	6,800
1,2-Dichloroethane	C	870
Dichloromethane	D	7,600
Lead	D	4,500[a]
Tetrachloroethene	D	36,000
Toluene	D	330,000
1,1,1-Trichloroethane	D	300,000
Trichloroethene	D	350,000
Vinyl Chloride	D	15,000

[a] Concentration in mg/kg.

Reference: Basewide Source Control and Remedial Action Plan, McLaren Engineering, July 1987.

Also, as described in Section 3.2 with the groundwater samples, the majority of the soil samples with the highest concentrations were located in Area D.

3.4 Historical Personal/Area Air Sampling Data

Personal and area air sampling were performed during bore hole drilling activities associated with Stage 2-2, 2-4, and 2-5 of the Phase II Installation Restoration Program (IRP) at McClellan AFB. The air sampling was performed to determine employee exposure to volatile organic compounds potentially encountered while drilling monitoring wells on base. The air monitoring data also were used to aid individuals responsible for the health and safety of employees in their selection of appropriate personal protective equipment.

Types of measurements and air samples collected during Stage 2-2 work included photoionization detector (PID) readings, passive diffusion organic vapor monitors, and detector tube grab samples. PID measurements revealed no persistent or significant elevations from baseline, at any monitoring well sites. A total of 137 detector tube samples were collected for trichloroethene, 1,1,1-trichloroethane, perchloroethene, chloroform, and vinyl chloride.

1,1,1-Trichloroethane was periodically detected at trace levels, defined as perceptible color detectable on the tube, but below the stated minimum detection limit for that tube. Two detector tube samples resulted in concentrations of 50 parts per million (ppm) for 1,1,1-trichloroethane. These samples were collected at well sites 113 and 1012. One detector tube sample indicated a concentration of 25 ppm for trichloroethane at well site 1000. The other area air samples taken by detector tube for the various chlorinated solvents indicated concentration levels below the limit of detection (none detected).

Personal breathing zone samples were collected from one employee on each drilling rig (commonly the driller's helper). The samples were collected

by passive diffusion organic vapor monitors attached to the lapel of the employee's uniform. The samples were analyzed for organic solvents and vinyl chloride, using NIOSH methods.

The results from the personal breathing zone samples yielded concentrations from 0 to 2.0 ppm detected for 1,1,1-trichloroethane. No other chlorinated solvents or vinyl chloride were detected from the personal breathing zone samples.

3.5 Summary of Health Effects of Specific Substances

The most likely types of substances expected to be encountered, based on past environmental and personal sampling data as discussed in Section 3.2, 3.3, and 3.4, will be: 1,1,1-trichloroethane, trichloroethene, 1,2-dichloroethane, 1,1-dichloroethene, and vinyl chloride.

Health effects of these hazardous substances are summarized in the following paragraphs:

- 1,1,1-Trichloroethane (TCA). TLV = 350 ppm. Like other chlorinated hydrocarbons, inhalation and lung absorption of TCA vapor in air is the most important and rapid route of absorption into the body. The principal effect of over-exposure involves a general depression of the central nervous system. At extreme exposure, cardiac effects may occur. Chronic toxicity from TCA is very minor. Unlike other chlorinated hydrocarbons, TCA has not been associated with clearly evident liver or kidney damage. Because no evidence of carcinogenicity exists in epidemiologic and/or animal data, trichloroethane is classified by the U.S. EPA as Non-Carcinogenic for Humans.

- Trichloroethene (TCE). TLV = 50 ppm. The toxic effects from exposure to TCE are related to a depressant action on the central nervous system. Acute exposure to TCE vapors (1000 ppm

for two hours) produces headache and drowsiness, and adversely affects coordination. In addition, prolonged exposure to high levels of TCE results in mucous membrane irritation and even depression of the heart rate. Research indicates that the kidney and liver are the primary targets in chronic exposure. Animal studies even show kidney effects at the subchronic level of exposure. Based on experimental evidence from animal studies, trichloroethene is classified by the U.S. EPA as a Probable Human Carcinogen.

- 1,2-Dichloroethane (Ethylene Dichloride). TLV = 10 ppm. Studies in laboratory animals indicate that 1,2-dichloroethane is rapidly and extensively absorbed following either oral or inhalation exposure. Immediate symptoms of a high level acute exposure to 1,2-dichloroethane are central nervous system depression, and irritation of the respiratory tract and eyes as well as nausea and vomiting. In addition, clinical evidence of liver and kidney dysfunction exists. Chronic low-level exposure may produce indication of CNS depression along with nausea and vomiting. Pathologically, chronic exposure to 1,2-dichloroethane has been shown to damage the liver, kidneys and adrenal glands. Based on laboratory animal studies, the compound has been classified by the U.S. EPA as a Probable Human Carcinogen.

- 1,1-Dichloroethene (Vinylidene Chloride). TLV = 5 ppm. As in the case with most chlorinated organic solvents, oral or inhalation exposure provides 1,1-dichloroethene with easy access into the body. Acute exposure to airborne 1,1-dichloroethene results primarily in central nervous system, depression with the associated symptoms of hampered coordination, stupor, drunkeness, and even unconsciousness. Chronic exposure, either orally or through inhalation procedures, has strikingly similar results. In both cases, the liver and kidneys are the primary

targets. Based on laboratory animal studies, this compound has been classified by the U.S. EPA as a Probable Human Carcinogen.

- Vinyl Chloride. TLV = 5 ppm, PEL = 1 ppm. Vinyl chloride is considered to have a low order of acute toxicity. Contact of the skin or eyes with the liquefied gas can produce freezing and frostbite. Central nervous system depression will occur when animals and man are exposed to moderately high levels of the gas. Humans exposed to vinyl chloride in air at a concentration of 6,000 ppm for one-half hour experienced dizziness and drowsiness. This latter property made vinyl chloride at one time a candidate for an anesthetic agent, but other toxicity problems developed at the concentrations necessary for anesthesia. It is also now considered to be a liver toxicant. Based on epidemiologic studies supporting a causal association between exposure to vinyl chloride and cancer, this compound has been classified by the U.S. EPA as a Human Carcinogen.

4.0 HAZARD ANALYSIS

Tasks conducted during the remedial investigation phase of the RI/FS will involve potential risk to field and laboratory personnel. The physical and chemical hazards, associated with the anticipated work activities outlined below, will be analyzed in the following subsections.

Anticipated work activities include:

- Monitoring well installation using hollow-stem augering techniques;
- Monitoring well installation using air-percussion drilling techniques;
- Development and pumping of monitoring wells;
- Monitoring well sampling;
- Handling and disposal of drill cuttings;
- Ambient air monitoring, soil vapor and soil sampling;
- Packaging and shipment of samples; and
- Sample preparation and analysis of samples.

4.1 Physical Hazards

The general types of physical hazards associated with the work activities discussed above include:

- Mechanical. Cuts; contusions; being struck by or striking objects; being caught between objects; becoming entwined in rotating tools; and falling objects.

- Electrical. Possible excavation of buried cables and exposure of overhead power lines during drilling; lightening hazards during electrical storms; and electrical shock by electrical pumping equipment and electrical laboratory equipment.

- Fire. Possible excavation of buried gas lines; grass fires; and equipment fires.

- Thermal. Exposure to outside temperature extremes (above 70° Fahrenheit) while wearing protective clothing.

- Acoustical. Exposure to excessive noise during drilling operations involving hollow-stem augering and air-percussion drilling.

To ensure employee protection from these physical hazards, the following safety precautions will be implemented.

- Protective clothing, as outlined in Section 7.0, will be required during all routine on-site drilling operations.

- During the planning/mobilization phase of the program, the Project Safety Officer and/or Task Leader shall consult with base/municipal personnel about the location of utility lines and other such underground hazards. All McClellan AFB-required permits will be obtained including welding, drilling, and radioactive source permits. If drilling cuttings indicate the possible presence of underground drums or cylinders, drilling will be stopped immediately and the borehole will be closed. The closure procedures will be coordinated with base personnel.

- All moving equipment are road legal vehicles and will observe all the traffic regulations at McClellan AFB. Maintenance will be conducted on a routine (as needed) basis at the work site or

staging area. Prior to any drilling and maintenance operations and for overnight security, the work site will be cordoned off with yellow carton tape and/or reflective safety flagging to prevent any vehicle or pedestrian interference with the work site. Also, no work site will impede with any normal traffic ways without providing orange traffic delineators to direct traffic around the working site.

- The On-Site Safety Officer or Task Leader must be alert for the signs and symptoms of heat stress. A hazard exists when individuals are required to work in warm temperatures (above 70° Fahrenheit) while wearing protective clothing. Heat stress monitoring will be performed by the On-Site Safety Officer when these conditions are encountered. Field team members will also be observed for the following signs and symptoms of heat stress:

  - Dizziness;
  - Profuse sweating;
  - Skin color change;
  - Increased heart rate, 110 bpm (beats per minute) as measured by pulse beats, 15 seconds x 4 or 30 seconds x 2;
  - Body temperature in excess of 100° F, as measured by fever detectors (forehead straps); and
  - Vision problems.

  Any team member exhibiting any of these symptoms will be removed from field work immediately and requested to consume 2 to 4 pints of electrolyte fluid or cool water every hour while

resting in a shaded area. The individual should not return to work until symptoms are no longer recognizable. If the symptoms appear critical, persist or get worse, medical attention will be sought immediately.

- Field personnel exposures to noise from drilling activities will be monitored using sound level meters. If noise levels are detected at or above recommended exposure levels (1987-88 Threshold Limit Values®, as established by the American Conference of Governmental Industrial Hygienists) for continuous or intermittent noise, all personnel potentially exposed to those noise levels will be required to wear hearing protection devices.

- All personnel will follow the safety procedures specified in OSHA 29 CFR 1910.101, Compressed Gases (general requirements) when using gas cylinders.

4.2 Chemical Hazards

The chemical hazards associated with the work activities discussed in Section 4.0 result from chemicals detected in the groundwater and soil at McClellan AFB.

During the development, pumping and sampling of monitoring wells, the field team may encounter contaminants present in the groundwater and soil. Significantly contaminated soils and groundwater, if encountered, will produce elevated airborne concentrations and elevated point source concentrations that are readily detected when sampling split-spoon soil samples or cuttings with direct-reading instruments. Inhalation of fugitive organic vapors is the most likely route of personnel exposure in the work area; however, real-time air monitoring instruments will indicate the presence of vapors before a chronic inhalation hazard exists. Since air monitoring instruments will detect

elevated airborne vapor concentrations and elevated point source concentrations before a chronic inhalation hazard can exist, potential skin absorption and ingestion exposures are considered remote.

The preparation of samples for analysis may expose laboratory technicians to routine hazards associated with laboratory work. Standard laboratory safety procedures will be used to prepare and analyze these samples. Particular hazards arise in the use of corrosive and flammable liquids. These samples should be treated with care and will be handled inside a properly operating laboratory hood due to their potentially hazardous nature.

To ensure the employee protection from potential chemical hazards, the following safety precautions will be implemented:

- Protective clothing will be required during the various work activities, as outlined in Section 7.0.

- An air monitoring program as outlined in Section 5.0 will be implemented to measure airborne concentrations of volatile organic compounds potentially encountered during on-site RI/FS work.

- Chemical-resistant protective clothing and respiratory protection will be available at all work sites, in the support zone, in the event air monitoring results indicate the presence of elevated concentrations of organic vapors in air.

5.0 MONITORING PROGRAM

Personnel exposure to hazards and excessive noise will be monitored to ensure that exposures do not exceed acceptable limits. Airborne contamination will be measured by three methods: (1) photoionization using an HNu® detector, equipped with an 10.2eV lamp; (2) direct-reading Draeger® indicator tubes; and (3) organic vapor detector badges. Noise will be monitored with continuous and impulse sound-level meters, particularly during air-percussion drilling.

A member of the Radian Industrial Hygiene Staff will conduct audits to ensure compliance with this safety plan and to provide any additional support required. Specific procedures for the monitoring program will be added to this plan as remedial investigations occur. An audit checklist is included in Appendix B.

5.1 Photoionization Detection

An HNu photoionization detector (PID) will be taken into the field and operated during drilling activities (one instrument per rig) and other soil disturbing activities where contaminated soil or groundwater may be encountered. Each instrument will be calibrated using known calibration gases prior to leaving for the field each day. (A chlorinated span gas will be used and obtained from Scott-Marrin, Inc. 2001-H Third Street, Riverside, CA 92507, 714-784-1240.) The appropriate HNu detector lamp will be selected for chlorinated species.

5.2 Direct-Reading Detector Tubes

A Draeger® detector tube kit will be used to determine airborne concentrations of specific/key contaminants during work activities where HNu PIDs are being used to screen for volatile chlorinated hydrocarbons. During drilling or other work, a member of the field team will take periodic readings for certain chlorinated hydrocarbons as directed by the response criteria (Table 6-1). Detector tubes will be available for:

- 1,1,1-Trichloroethane;
- Trichloroethene;
- 1,1-Dichloroethene;
- 1,2-Dichloroethane; and
- Vinyl chloride.

These chlorinated hydrocarbons represent the most frequently detected species reported, based on past groundwater and soil sample analytical results.

The readings are taken by drawing a known volume of air through a detector tube and observing a colorimetric indication of airborne concentration. Measurements will be taken in areas where the field team members are working and at the well-head during drilling. A log of the detector tube observation results will be made part of the permanent McClellan RI/FS program file. The time, date, location, type of detector tube, any observed color change, and the name of the individual taking the measurement will be recorded in the program file.

5.3 Vapor Badge Monitoring

Personnel exposure to organic vapors will be monitored using 3M Brand #3520 organic vapor monitors® (badges). Only personnel working closest to the well-head opening will be monitored. The procedures to be followed when using these monitors are:

- Open the badge, and remove the plastic cap covering the charcoal bed.

- Mark the date and sampling start time on the badge.

- Place the badge on an individual who spends the most time near the well opening (greatest potential of being exposed to organic vapors). The badge should be placed on the outside of

the individual's clothing, near the breathing zone. (The lapel on the collar will be sufficient).

- The badge will collect organic vapors automatically.

- At the end of the sampling period (usually eight hours), place the plastic cap on the badge, mark the end of the sampling time, and forward the badge to the Project Safety Officer. A representative number of badges will be analyzed for 1,1,1-trichloroethane, trichloroethene, 1,1-dichloroethane, vinyl chloride and 1,2-dichloroethene, using gas chromatography. Direct reading air monitoring data and observations noted in the field will mandate the selection of badges to be analyzed. The results will be made part of the permanent program file. Excessive exposures will be reported immediately to the affected individual and his/her supervisor.

5.4 Noise-Level Monitoring

Field personnel exposures to noise during drilling activities will be monitored using sound-level meters. The procedures to be followed in measuring noise exposure are:

- Calibrate the sound level meter using the calibration device provided with the instrument. Place the calibrator over the microphone and turn it on. The calibrating device is pre-set to deliver a specific decibel level. Check to see that the instrument is reading the exact pre-set level. Adjust the sound level meter as required.

- After calibration of the instrument, set the scales, and record the noise levels at specific work locations during any drilling activities suspected of producing excessive noise.

- Noise-level readings will be recorded in a log, noting the scale, response setting, time, date, analyst, type of activity, individuals potentially exposed, and the noise-level reading. These records will be made part of the permanent program file. .f excessive noise levels are detected, then corrective actions will be taken as specified in Section 4.1.

6.0 CHLORINATED HYDROCARBON HAZARD CRITERIA

Chlorinated hydrocarbon hazard criteria have been developed to assist Task Leaders and On-Site Safety Officers in deciding when the use of respirators and Tyvek® coveralls may become appropriate.

Exposure to elevated levels of chlorinated hydrocarbons presents potential health risks that need to be properly controlled. Where elevated exposures persist, respiratory protection will be the primary control method to protect personnel from inhalation of chlorinated hydrocarbon vapors. Elevated levels in the air serve as presumptive evidence of elevated chlorinated hydrocarbon levels in the soil or water. The use of chemically impervious Tyvek® suits, nitrile rubber gloves, and neoprene safety boots will be the primary control measure to protect personnel from dermal exposure to chlorinated hydrocarbons. The chlorinated hydrocarbons potentially encountered during drilling activities are composed of a variety of industrial solvents, including: 1,1,1-trichloroethane, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethane. Vinyl chloride gas may also be encountered.

These contaminants present limited exposure potential, requiring minimal controls at the concentrations expected. In the event personal and area air monitoring efforts detect hydrocarbon concentrations that present the potential for personnel exposure, the use of personal protective equipment will be upgraded from U.S. EPA Level D equivalent to U.S. EPA Level C (respiratory protection, Tyvek® coveralls, and chemical resistant gloves and boots). A Chlorinated Hydrocarbon Criteria and Response Guide (Table 6-1) has been compiled for guidance as to when to upgrade personal protective equipment and how to determine when to stop work.

At any point that air monitoring results indicate the need to upgrade personal protective equipment, that level of protection also will become necessary for all subsequent activities at that location. The McClellan AFB safety officer will be notified.

TABLE 6-1. CHLORINATED HYDROCARBON CRITERIA AND RESPONSE GUIDE

Response Level	Chlorinated Hydrocarbon Concentration (CHC)	Response
#1	2-5 ppm total CHC by photo-ionizer	Collect detector tube samples for vinyl chloride at the well head and at worker breathing zone (BZ) every 30 minutes or additional 10 feet depth drilled, or until photoionizer readings drop below 2 ppm. Air supplied respirators, Tyvek® suits, nitrile gloves, and neoprene boots must be worn by all employees when results by detector tubes for vinyl chloride and 1,2-dichloroethane are positive when collected at worker's BZ.
#2	5-100 ppm total CHC by photoionizer	Collect detector tube samples at the wellhead and at worker breathing zone (BZ) for all parameters[a] every 30 minutes or additional 10 feet depth drilled; or until photoionizer readings drop below 5 ppm. Air supplied respirators, Tyvek® suits, nitrile gloves, and neoprene boots must be worn by all employees when results by detector tubes for vinyl chloride and 1,2-dichloroethane are positive. See #5.
#3	100-500 ppm total CHC by photoionizer	Air purifying respirators Tyvek® suits, nitrile gloves and neoprene boots must be worn by all employees with the exception of vinyl chloride and 1,2-dichloroethane. See #5. Continue collection of detector tube samples.
#4	> 500 ppm total CHC by photoionizer	Work stops. Continue collecting detector tube samples while initiating action to suppress vapors (water spray, contain cuttings, etc.). Work crew positions themselves upwind from cuttings/borehole.
#5	> TLV® for any parameter by detector tubes	Air purifying respirators, Tyvek® suits, nitrile gloves, and neoprene boots must be worn by all field team members for all parameters with the exception of vinyl chloride and 1,2-dichloroethane. If vinyl chloride and/or 1,2-dichloroethane is detected above their TLV, then air supplied respirators will be substituted for air purifying respirators.
#6	>10 times the TLV® for any parameter by detector tubes	Work stops. Suppress vapors. Reevaluate.

(Continued)

TABLE 6-1. (Continued)

TLVs® - (Threshold Limit Values recommended by the American Conference of Governmental Industrial Hygienists for 1987-88)

1,1,1-Trichloroethane	=	350 ppm
Trichloroethene	=	50 ppm
1,1-Dichloroethene[b]	=	5 ppm
1,2-Dichloroethane[c,d]	=	10 ppm[e]
Vinyl Chloride	=	1 ppm

[a] Sampling parameters are: 1,1,1-trichloroethane, trichloroethene, 1,1-dichloroethene, 1,2-dichloroethane, and vinyl chloride.

[b] Vinyl chloride detector tubes will be used for detection of 1,1-dichloroethene. Vinyl chloride tubes respond at 1:1 ratio for both contaminants.

[c] 1,2-Dichloroethane detector tubes have a lower limit of detection of 100 ppm, and therefore, will not be used as criteria for response level #5.

[d] Methyl bromide detector tubes will be used for detection of 1,2-dichloroethane. These tubes will detect 1,2-dichloroethane at 50 ppm, which also is the Occupational Safety and Health Administration Permissible Exposure Limit 29 CFR 1910.1000.

[e] Occuptational Safety and Health Administration Permissible Exposure Limit 29 CFR 1910.1017.

If air contaminants are detected in excess of response level #3, as defined in Table 6-1, detector tube and photoionizer monitoring also will be conducted downwind of drilling activities at the edge of the Exclusion Zone. To minimize potential risks to adjacent areas, drilling activities will be halted if any detectable levels of airborne contaminants are measured by detector tubes and the McClellan AFB Environmental Management Project Officer will be notified.

7.0 PERSONAL PROTECTIVE EQUIPMENT

Based on the past groundwater and soil monitoring data and air sampling data, (as indicated in Sections 3.2, 3.3, and 3.4), the required personal protective equipment for the McClellan RI/FS will consist of U.S. EPA Level D protection (or equivalent) used in conjunction with an intensive air monitoring program. The specific personal protective equipment for U.S. EPA Level D protection consists of the following items:

- Boots/shoes--leather or chemical-resistant with steel toe and shank;
- Safety glasses with side shields or chemical splash goggles;
- Hard hat; and
- Work uniform, coveralls, or equivalent work clothing to cover the majority of exposed skin.

Nitrile or neoprene gloves will be worn by workers whenever the potential for direct skin contact with contaminants is possible.

Considerations mandating the use of U.S. EPA Level D personal protective equipment are as follows:

- Depending on site and drilling conditions, the On-Site Safety Officer and/or Task Leader, in coordination with the Project Safety Officer, may increase or decrease the level of personal protection and the McClellan AFB Environmental Management Project Officer will be notified.
- Respiratory protection and chemical-resistant clothing will be available at all drilling and sampling locations. The use of

this personal protective equipment will be required if air monitoring results exceed the chlorinated hydrocarbon criteria presented in Section 6.

- Personal protective equipment required will vary, depending on the specific job being performed. Table 7-1 presents guidelines for use of personal protective equipment associated with the various tasks.

- Personal protective equipment will be upgraded from U.S. EPA Level D protection to Level C protection if at anytime the HNu Photoionization Analyzer fails to function or maintain calibration. U.S. EPA Level C personal protective equipment consists of:

  - Full-facepiece, air-purifying, canister-equipped respirator,
  - Chemical-resistant clothing (disposable chemical-resistant one-piece suit),
  - Inner and outer chemical-resistant gloves,
  - Chemical-resistant safety boots/shoes,
  - Hard hat,
  - Two-way radio communications, and
  - Air supplied respirators will be required if monitoring results exceed the criteria levels for vinyl chloride and/or 1,2-dichloroethane (see Table 6-1).

- Subcontractors will use respirators that are approved by NIOSH and MSHA for the parameters of exposure. The Radian on-site Health and Safety Officer shall note the make and model numbers of the equipment used by the subcontractors in the field Health and Safety Log.

RADIAN CORPORATION

TABLE 7-1. USE GUIDELINES FOR PERSONAL PROTECTIVE EQUIPMENT

	Hollow-Stem Auger Drilling	Air-Percussion Drilling	Development, Pumping, Handling Well Drill Cuttings, and Sampling of Monitoring Wells	Packaging and Shipment of Groundwater Samples	Sample Preparation and Analysis
Air supplied respiratory protection, such as air line respirators or self-contained breathing apparatus (SCBA).	A	A	A	-	-
Half-face air purifying respirator with organic vapor cartridges	A	A	A	A	A
Chemical-resistant clothing (Tyvek® coveralls)	A	A	A	A	A
Work uniform, coveralls, or equivalent work clothing	X	X	X	X	X
Nitrile rubber gloves	X	X	A	A	A
PVC disposable gloves	A	A	X	X	X
Boots, chemical-resistant, steel toe and shank	A	A	A	-	-
Boots, leather, steel toe and shank	X	X	X	-	-
Hard hat	X	X	A	-	-
Safety glasses with side shields or chemical splash goggles	X	X	X	X	X

X = Required use.
A = Available if needed.

- Note - The level of protection provided may be decreased when additional information on site conditions show that decreased protection will not result in hazardous exposures to workers.

8.0 SITE CONTROL AND WORK ZONES

To minimize the transfer of potentially hazardous substances from the site and to protect the environment and public health, contamination control procedures are necessary. Contaminants must be removed from people and equipment prior to movement from the work zones.

8.1 Work Zones

The field team shall prevent uncontrolled waste material from moving from a drilling site and from affecting the site itself. The team will prevent migration of site contaminants by establishing work zones and equipment/personnel decontamination procedures. The zones to be established during drilling are:

- Exclusion Zone. An "Exclusion Zone" will be established to encompass an approximate 50-foot-diameter circle surrounding the drilling site. Potentially hazardous airborne contaminants and physical hazards to the workers will be contained in this zone. Plastic (PVC or comparable) sheeting and/or tarps will be used to control cuttings spilled to the ground during drilling operations and containerization of cuttings. The size and shape of the Exclusion Zone may be modified to accommodate site conditions. No personnel will be permitted into the Exclusion Zone unless they are in full compliance with the existing safety plan.

- Contamination Reduction Zone. The Contamination Reduction Zone will be established as a buffer zone between the Exclusion Zone and the Support Areas. All personnel and equipment exiting the Exclusion Zone will do so through the Contamination Reduction Zone. This zone will contain the personnel and equipment decontamination materials as described in Section 8.3.

- Support Zone. A Support Zone must be defined for each field activity. The zone should be at least 50 feet up wind from the drilling rig and should be clean and free of potentially contaminated cuttings and equipment.

8.2 Buddy System

No employee will work alone in the Exclusion Zone. Each worker will have a co-worker with whom visual contact will be maintained at all times. The buddy system will ensure against an employee becoming heat stressed without a co-worker being aware of his/her condition. It also will enable co-workers to "watch out" for each other while in the proximity of potential chemical and physical hazards, and to observe the integrity of personal protective equipment.

8.3 Decontamination Procedures

Decontamination of equipment that has been in direct contact with subsurface soils and groundwater will be important to prevent contaminants from spreading to subsequent drilling locations. Personnel decontamination will be accomplished by good personal hygiene. Contamination should not be present on the skin if the proper protection methods specified in this plan are used. However, all field team members will follow these guidelines to ensure that contamination does not remain on equipment, sample containers or in contact with their bodies.

- Remove all equipment, sample containers, and other materials potentially exposed from the Exclusion Zone to the Contamination Reduction Zone. Obtain decontamination solution (water) and decontaminate the spades, shovels, auger flights, etc. by brushing them under a water rinse. A high-pressure steam cleaner also may be used for decontamination. Handling and disposal methods for drill cuttings and spent decontamination solutions will be specified in the specific work plans.

- All personnel will wash their hands, face, neck and forearms before consuming any food or liquids, smoking, or using the restroom.

9.0 EMPLOYEE/CONTRACTOR TRAINING

All employees assigned to the site shall be thoroughly trained in accordance with the Occupational Safety and Health Administration (OSHA) interim final standard (29 CFR 1910.120) to protect workers in hazardous waste operations. The rule requires that all employees who may be exposed to hazardous conditions at hazardous waste sites shall receive at least 40 hours of health and safety instruction, to include 8 hours annual refresher training, 8 hours supervisors additional training if applicable, and respirator training and fit-testing, prior to engaging in any hazardous waste operations.

In addition to the 40 hours health and safety instruction, all Radian employees involved in the field work activities shall have been trained in CPR/first aid and shall have current certification.

On-site training will consist of a review of this Health and Safety Plan followed by a question and answer session accompanied by the McClellan AFB Environmental Management Project Officer. All on-site training will be documented in an On-Site Training Log. Each section of the plan is intended to provide information to assist in accomplishing each task in a safe manner. It will be the responsibility of the Task Leader, On-Site Safety Officer, and the subcontractor supervisor to ensure that the field team has this plan on site at all times during drilling and sampling operations, reads the safety procedures contained herein, and understands how to conduct this work safely. It will be the individual's responsibility to bring to the attention of the On-Site Safety Officer any portion of this plan and related training that he or she does not fully understand. Prior to beginning site work, the field team and McClellan AFB Environmental Management Project Officer will meet to discuss the contents of this plan to ensure that all members are adequately informed in safe work practices and the meeting documented.

9.1 Health and Safety Training

Prior to starting the work, the Task Leader or the On-Site Safety Officer will conduct a training session so that each field team member under-

stands his or her safety responsibilities. All field team members will be informed of potential health and safety hazards. Daily health and safety meetings will be conducted to review the safe work practices that will be performed in accordance with the scheduled activities. Specifically, the following topics will be covered in the initial training session:

- Review of the Health and Safety Plan;
- Potential routes of contact with toxic and or corrosive materials, excessive noise, or physical site hazards. Potential chemical exposure routes include:
  - Skin contact/absorption,
  - Eye contact,
  - Inhalation, and
  - Ingestion;
- Types, proper use, limitations and maintenance of applicable protective clothing and equipment. This equipment includes:
  - Eye protection,
  - Gloves,
  - Safety boots,
  - Tyvek® coveralls, and
  - Respirators;
- Respiratory protection using air-purifying respirators equipped with organic vapor cartridges and dust filters. The following will be discussed:
  - Forms of respirators: air-purifying, air-supplied, and self-contained,
  - Selection of respiratory protection based on the hazard,
  - NIOSH certification of all equipment to be used on site,

  - Medical/physical fitness to wear respiratory protection, and

  - Use, limitations and maintenance of half-face respirators including qualitative fit testing, routine inspection, replacement of parts, cleaning, disinfection, decontamination, and storage requirements;

- Proper decontamination procedures and adherence to work zone boundaries;

- Proper waste/cuttings handling and disposal procedures as specified in the work plan;

- Reporting of accidents and availability of medical assistance;

- Medical/physical fitness to wear respiratory protection;

- Air monitoring procedures and strategies; and

- Operation of the fire extinguishers supplied and their proper use against fires.

In the event all field team members cannot attend the training session, those missing the session will be responsible for understanding the contents of this plan in its entirety and informing their immediate supervisor of any questions.

10.0 MEDICAL CONSIDERATIONS

10.1 General Medical Surveillance

All Radian and subcontractor personnel will be enrolled in an on-going medical surveillance program per the requirements of OSHA's hazardous waste operations regulation (29 CFR 1910.120). Therefore, all personnel will have had a medical examination within 12 months of the start of the project and will have another medical examination within 12 months of the end of the project. (All personnel receive annual medical examinations.) The occupational physician conducting the examinations will be informed of the potential exposure to hazardous materials at McClellan AFB. The baseline, or pre-employment, physical consists of:

- History and physical;
- Occupational history;
- Reproductive history;
- Occupational health chemistry panel;
- Complete blood count;
- Urinanalysis;
- Chest X-ray;
- Pulmonary function testing; and
- Other tests as indicated by health or exposure history.

The annual medical examination consists of:

- Medical and occupational history update;
- Physical examination;
- Occupational health chemistry panel;
- Complete blood count;
- Urinanalysis; and
- Pulmonary function testing.

A copy of the physician's written opinion regarding fitness for this type of work, including results of relevant examinations and tests, will be given to all employees, and maintained in Radian's Sacramento office.

10.2 Project-Specific Medical Surveillance

A medical examination will be performed if an employee develops signs or symptoms indicating possible over-exposure to hazardous substances and/or heat stress.

No routine project-specific medical surveillance will be performed as no substances or conditions are anticipated at the site that would produce disease or biological changes not detected by the general medical surveillance program.

11.0 EMERGENCY RESPONSE PLAN

Emergency procedures listed in this plan are designed to give the field team instruction in handling medical emergencies, fires and explosions, and excessive emissions during drilling/coring.

11.1 Injuries

Medical problems that can occur on site need to be handled competently and quickly. Each field team member should be aware of the instructions and information given below:

- Write down and post the telephone numbers of local base and community ambulances and medical facilities (page 12-3) and location from which to place the call.
- Seek immediate professional medical attention for personnel who are bleeding severely, not breathing, experiencing intense pain or are unconscious. Each member of the field team should know how to call for an ambulance.
- If employees get anything in their eyes (chemicals or dust), flood the eyes with water for 15 minutes. The On-site Safety Officer and/or Task Leader should be notified immediately of the problem.
- Do not remove objects that are impaled (stuck) in the eye.
- Always seek medical attention for eye injuries.
- Stop bleeding with direct pressure. Place a bandage over the wound and press firmly. Use a tourniquet only in extreme cases when unable to stop severe bleeding.

- If an employee contacts contaminants, wash the affected area with soap and water as soon as possible. If large amounts of waste come in contact with the body, a full-body shower with soap will be required immediately. The employee will be taken or directed by the Field Task Leader to the on-base support facilities for full body showering established prior to operation with McClellan's Safety Officer.

11.2 Emergency Equipment Needs

The following equipment must be kept in the Contamination Reduction Zone:

- Portable emergency eye wash;
- Two 20-pound ABC-rated fire extinguishers (during drilling operations); and
- An adequately stocked first-aid kit.

11.3 Fire and Explosion Response Procedures

Fires on site can be started by natural occurrence, or by unsafe work activities. The field team should have a multipurpose (A, B, C) fire extinguisher on hand at all times. The procedure for using a fire extinguisher is to pull the safety pin, point the extinguisher at the base of the flames and discharge the extinguisher by sweeping the flames from a distance of about 6 feet. The extinguisher operator should move in as the flames are being put out.

- Never use water on an electrical fire or a solvent fire. All extinguishers should be dry chemical and labeled "Class A, B, C."

- Keep decontamination solvents and engine fuels well away from any ignition sources.

The On-Site Safety Officer and/or Task Leader will notify the Fire Department of the location and anticipated work activities in order to minimize the fire risk to the surrounding neighborhoods. In addition, flammable brush and grass will be cleared away from the drilling site prior to initiation of drilling activities. If welding is required, welding permits will be secured before starting.

11.4 Operations Shutdown

Drilling operations may be suspended for several reasons. Monitoring for airborne contamination will be conducted at the drilling site. When an increase of 2 ppm above background (measurement taken prior to any drilling activities) is detected at the well-head by the photoionization detector analyses, additional monitoring with detector tubes will be initiated. Detector tube samples will be collected near the breathing zone (BZ) area of workers closest to the open hole and directly at the well-head. Detector tubes used will be for: 1,1,1-trichloroethane, trichloroethene, 1,1-dichloroethene, vinyl chloride and 1,2-dichloroethane. The following criteria will be used to determine when operations must be stopped:

- Detector tubes indicate concentrations 10 times the Threshold Limit Values (TLVs®) established by the American Conference of Governmental Industrial Hygienists (ACGIH) for 1,1,1-trichloroethane (350 ppm), trichloroethene (50ppm), 1,1-dichloroethene (5 ppm), or 1,2-dichloroethane (10 ppm) at BZ, and vinyl chloride (1 ppm) established by OSHA 29 CFR 1910.1017;

- Photoionizer indicates 500 ppm total hydrocarbon vapors at BZ; or

- Radian's On-Site Safety Officer, McClellan AFB Environmental Management Project Officer, and/or Task Leader observes flagrant non-compliance with the Health and Safety Plan.

When any of these conditions exist, the drilling operations will stop, cuttings containers will be closed, the borehole covered, and the site secured. All personnel will leave the work area until Radian's On-Site Safety Officer and/or Task Leader has determined that operations may resume.

In addition, drilling will stop and the derrick will be lowered during high winds or electrical storms.

12.0 RECORDKEEPING REQUIREMENTS

The following recordkeeping requirements are to be maintained in the program file indefinitely:

- Copy of this McClellan AFB RI/FS Health and Safety Plan;
- Signed copy of the Health and Safety Certification Form;
- Log of all on-site training meetings;
- Any accident/illness report forms;
- Air monitoring results; and
- Personal sampling results.

RADIAN CORPORATION

HEALTH AND SAFETY CERTIFICATION FORM

Project Title: McClellan Air Force Base Integrated RI/FS

Project Manager: Morey Lewis, Radian

Project Safety Officer: Rory W. Morgan, Radian

On-Site Safety Officers: Barbara St. Germaine, Radian

I certify that I have been given a copy of the Health and Safety Plan for the McClellan Air Force Base Integrated Remedial Investigation/Feasibility Study (RI/FS) and agree to comply with the procedures described therein. I further certify that I understand the potential health and safety hazards of the program (as outlined in the Health and Safety Plan) and have been trained in the use of the personal protection equipment selected for this project.

Employee: _____

(Print) (Signature) (Date)

Project Manager: _____

(Print) (Signature) (Date)

Project Safety Officer: _____

(Print) (Signature) (Date)

On-Site Safety Officer: _____

(Print) (Signature) (Date)

RADIAN CORPORATION

EMERGENCY TELEPHONE LIST

HOSPITALS: On Base (if life threatening) - 115
Out Patient Clinic Bldg 541

Off Base - 965-2155
Mercy-San Juan Hospital - Emergency Room
6501 Coyle Avenue
Carmichael, CA

FIRE: On Base - 117 -or- 643-6666
Off Base - 911

AMBULANCE: On Base - 115
Off Base - 911

POLICE: On Base - 112 -or- 643-2111
Off Base - 911

RADIAN SAFETY OFFICER: Office - 362-5332
Home - 722-9032

BASE SAFETY OFFICER: Ron Gamber - 643-6227

ENVIRONMENTAL MANAGEMENT: Environmental Management - 643-1250
Mario Ierardi
Bud Hoda
Jerry Robbins
Paul Brunner
Charlie Thorpe

SURGEON GENERAL BRANCH: Beeper - 328-2042

APPENDIX A

Site Summary Tables

TABLE A-1. INVESTIGATED SITES AT McCLELLAN AFB

Site	Area	Site Status[1]	Description	Location	Size (feet)	Identified Contaminants[2]	Site Cover	Phase I Site Rating Score	HRS Score
1	D	I	Landfill	NW Corner of Base	10,500 sq. ft.	PP	Yes	81	—
2	D	I	Sludge/Oil Pit	NW Corner of Base	20,000 sq. ft.	PP	Yes	71	—
3	D	I	Sludge/Oil Pit	NW Corner of Base	50,700 sq. ft.	PP	Yes	71	—
4	D	I	Sludge/Oil Pit	NW Corner of Base	15,000 sq. ft.	PP	Yes	72	—
5	D	I	Sludge/Oil Pit	NW Corner of Base	15,800 sq. ft.	PP	Yes	71	—
6	D	I	Oil Burn Pit	NW Corner of Base	7,500 sq. ft.	VOC/ME	Partial	71	—
7	C	I	Sludge/Oil Pit	E of Bldg. 701	380 x 93 x 23	PP/OG/PCB	No	67	22.58
8	C	I	Sludge and Refuse Landfill	600' NW of Bldg. 774	435 x 135 x 20	VOC/BN	No	66	22.67
9	C	I/NS	Landfill	300' W of Bldg. 774	400 x 100 x 50	PP	No	60	8.70
10	C	I	Landfill	500' W of Bldg. 774	530 x 100 x 15	PP/PCB	No	66	22.58
11	C	I	Landfill	600' W of Bldg. 774	405 x 80 x 8	PP	No	66	22.58
12	C	I	Landfill	800' SW of Bldg. 774	810 x 90 x 12	PP	No	66	22.58
13	C	I	Landfill	1000' W of Bldg. 774	800 x 90 x 15	PP	No	66	37.54
14	C	I	Landfill	Near Patrol Rd 300' S of Bldg. 701	800 x 80 x 14	PP	No	66	22.58
15	C	I/NS	Sodium Valve Trench	800' SW of Bldg. 774	15 x 2 x 9	NC	No	44	0
16	C	I/NS	Sodium Valve Trench	Near Patrol Rd 800' S of Bldg. 701	15 x 2 x 9	NC	No	44	0
17	C	I/NS	Landfill	SE of Bldg 704	400 x 100 x 50	VOC	No	65	0
18	C	I/NS	Landfill	SE of Bldg 704	400 x 100 x 50	NC	No	65	0
19	C	I/NS	Landfill	SE of Bldg 704	400 x 100 x 50	NC	No	65	0
20	C	I/NS	Sludge/Oil Pit	SE of Bldg 704	250 x 220	VOC	No	64	0
21	C	I/NS	Sludge/Oil Pit	SE of Bldg 704	250 x 220	VOC	No	64	0
22	C	I	Burn Pit and Landfill	S of IWTP Aeration Basin	400 x 100	PP/PCB/OG	No	60	48.37
23	Other	I	Landfill	W edge of Base, at Bldg. 781	400 x 60 x 24	PP	Partial	35	48.51
24	Other	I	Landfill	E of Bldg. 821	515 x 80 x 11	PP	Partial	37	37.20
25	A	I/NS	Landfill	S end of North/South Runway	615 x 160	NC	Partial	37	0.52
26	D	I	Sludge Pit, Oil Burn Pit	NW Corner of Base	40,000 sq. ft.	VOC/ME	Yes	71	—
27	D	I	Sodium Valve Trench	Beneath Bldg. 1085	100 sq. ft.	NC	Partial	—	—
28	C	I/NS	Sludge Pit	W of the IWTP	85 x 35 x 6	PP	Yes	50	4.34
29	Other	I/NS	Landfill	NE of Bldg. 700	350 x 350	NC	No	42	0.60
30	B	I	Landfill (Radiological Chemical Lab)	E of Bldg. 828	140 x 280	VOC/ME	Partial	—	33.47
31	Other	I/NS	Incinerator Ash Burial Pit	Near Bldg. 880	350 x 150	Arsenic	No	41	11.82

1. I = Investigated.
   NS = Site identified as having no waste or significant soil contamination identified by McLaren Environmental Engineering
2. Key to Identified Contaminants:
   NC - no contamination detected
   BN - base/neutral priority pollutants
   CN - cyanide
   ME - metals
   OG - oil and grease
   PCB - polychlorinated biphenyls
   PH - petroleum hydrocarbons
   PP - priority pollutants (all except pesticides)
   TEL - tetraethyl lead
   VOC - volatile organic compounds
   IWTP = Industrial waste treatment plant
   - = score not determined

TABLE A-1. (Continued)

Site	Area	Site Status[1]	Description	Location	Size (feet)	Identified Contaminants[2]	Site Cover	Phase I Site Rating Score	HRS Score
32	C	I/NS	Radioactive/Hazardous Waste Storage	S of IWTP	160 sq. ft.	PP	Partial	51	4.49
33	D	I	Industrial Wastewater Sludge Landfarm	NW Corner of Base	2000,000 sq. ft.	VOC	No	52	—
34	Other	I	Waste Solvent Storage Tanks	1300' E of Bldg. 840	100 sq. ft.	PP	No	38	20.77
35	B	I/NS	Scrap Metal Burial Pit	W of and Under Bldg. 852	220 x 160	NC	Partial	—	0.82
36	B	I	Open Storage Area	N of Bldg. 666	150 x 200	VOC/CN	Partial	—	27.89
37	A	I	Landfill	Adjacent to Taxiway 7165	500 x 250	VOC/OG	Partial	—	18.74
38	A	I	Underground Tanks/Sludge Landfill	Bldg. 475	600 x 400	VOC/BN	Yes	65	37.80
39	A	I/NS	Landfill	S of Bldg. 351	625 x 160	NC	Yes	60	9.52
40	A	I	Industrial Wastewater Sludge Drying Beds	NE of Sanitary WTP	190 x 110	VOC	Yes	66	27.90
41	C	I	Landfill	S of and Under Bldg. 704	560 x 190 x 15	PP/ME	Partial	49	21.70
42	C	I	Oil Storage/Landfill	Under IWTP Aeration Basin	210 x 50 x 8	PP/OG/PCB	Yes	—	40.37
43	C	I	Landfill	NW of Bldg. 704	405 x 50 x 10	PP	No	49	22.58
45	Other	I/NS	Paint Waste Landfill	N End of Base	750 x 200	NC	No	42	0.50
47	B	I	Abandoned Plating Shop	Bldg. 666	210 x 210	VOC/ME	Yes	—	27.90
48	B	I	Abandoned IWTP	IWTP #4	50 x 50	VOC/ME/OG	Yes	—	33.47
49	C	I/NS	Landfill	NE of Bldg. 704	500 x 90	NC	No	—	0
50	C	I/NS	Setting Pond	NW of Bldg. 704	150 x 75	NC	Yes	—	0
51	C	I/NS	Holding Pond	NW of IWTP	600 x 300	NC	Yes	—	0
52	C	I	Burn Debris Pit	NW of Bldg. 704	400 x 50 x 3	PP	Yes	—	20.84
53	C	I/NS	Settling Pond	NW of Bldg. 704	550 x 175	VOC	Yes	—	0
54	C	I/NS	Storage Area	S of Bldg. 704	90 x 70	NC	No	—	0
55	C	I/NS	Storage Area/Landfill	S of Bldg. 704	80 x 15	VOC	Yes	—	0
56	C	I/NS	Storage Area	S of Bldg. 704	500 x 200	NC	No	—	0
57	C	I/NS	Landfill	S of Bldg. 704	500 x 50	NC	No	—	0
60	C	I/NS	Holding Pond	SW of IWTP	1000 x 80	NC	Yes	—	0
61	C	I/NS	Chemical Waste Pit	E of Bldg. 722	50 x 10	NC	Yes	—	0
62	C	I/NS	Chemical Waste Pit	E of Bldg. 722	50 x 10	NC	Yes	—	0
63	C	I/NS	Unlined Ditch	SE of Bldg. 704	400 x 50	NC	Partial	—	0
64	C	I/NS	Unlined Ditch	SE of Bldg. 704	400 x 50	NC	Partial	—	0
65	C	I/NS	Landfill	E of Bldg. 692	400 x 100	NC	Yes	—	0
66	C	I/NS	Ditches and Pond	W of Bldg. 721	—	NC	Partial	—	0
67	C	I	Landfill	NW of Bldg. 702	200 x 200 x 6	PP/PH	Yes	—	19.98
68	C	I	Sludge Ponds	W of Triangular Oil Storage Pond at Site 42	210 x 60 x 6	PP	Yes	—	22.32
69	C	I	Burn Pit	SE of Bldg. 704	—	PP	No	—	22.58
S	D	I	Fuel, Solvent Disposal Pit, Oil Burn Pit	NW Corner of Base	9,200 sq. ft.	VOC/BN/PH/TEL	Yes	—	—
T	D	I	Fuel, Solvent, Sludge Disposal Pit	NW Corner of Base	8,400 sq. ft.	VOC/BN/ME/PH/TEL	Yes	—	—
A	D	I	Sludge Disposal Pit	NW Corner of Base		VOC/BN/ME		—	—

TABLE A-2. UNSTUDIED SITES IDENTIFIED AT McCLELLAN AFB

Site	Area	Description	Location	Potential Contaminants
B1	Other	Landfill	E of Bldg. 700	Unknown
B2	Other	Spoil Pit/Borrow Pit	Under North/South Runway	Unknown
B3	A	Landfill	Under Bldg. 251	Solvents, Petroleum
B4	A	Sludge Drying Beds	Under Sanitary WTP	Solvents, Metals
B5	A	Landfill	S of Bldg. 375	Petroleum, Solvents
B6	Other	Waste area	N of North/South Runway	Unknown
B7	A	Spoil Area	N of Bldg. 243	Solvents, Petroleum
B9	Other	Landfill	E of Bldg. 700	Unknown
P1	A	Drainage Ditch/ponds	W of Bldg. 878	Solvents, Petroleum
P2	Other	Waste Pond	S of Bldg. 687	Petroleum, Solvents
P3	A	Oil Pit	S of Bldg. 251	Solvents, Petroleum
P4	A	Sump	E of Bldg. 351	Solvents, Petroleum
P5	A	Open Ditch	Bldg. 475	Solvents, Other
P6	A	Open Ditch	Bldg. 475	Solvents, Other
P7	Other	Open Ditch	From Bldg. 1020 Area to Area D	Petroleum, Solvents
P8	Other	Acid and Cyanide Pit	N of 47th St., S end of N/S Runway	Acid, Metals, Cyanide
P9	B	Open Drainage Ditch	Bldg. 666	Solvents, Metals
S1	A	Old Plating Shop	In Bldg. 343	Solvents, Metals, Cyanide
S2	A	Chemical Warehouse	In Bldg. 447	Solvents
S3	A	Acid Storage Warehouse	W of Bldg. 447	Acids
S4	A	Old Treatment Plant and Sludge Beds	N of Bldg. 431	Solvents, Metals, Petroleum
S5	B	Industrial Waste Treatment Plant	N of Bldg. 642	Priority Pollutants
S6	A	IWTP #1	SE Side of Base	Priority Pollutants
S7	A	IWTP #3	NE of Bldg. 475	Priority Pollutants
S8	A	Electroplating Shop	Bldg. 243 G	Metals, Cyanide, Solvents
S9	B	Asbestos Storage	E of Bldg. 642	Asbestos
S10	Other	Storage Area	NW End of NW/SE Runway	Solvents, Other
S11	Other	DCE Storage Area incl PCB storage at Bldg 638	W of N/S Runway on S End	PCB, Solvents, Petroleum
S12	B	PCB Storage	Bldg. 824	PCB
S13	Other	Open Storage	Near Bldg. 709	Solvents
S14	A	Paint Shop and Spray Booth	Bldg. 22	Solvents, Petroleum
S15	A	Repair Shop, Degreaser, Spray Booths	Bldg. 243	Solvents, Petroleum
S16	A	Repair Shop/Solvent and Paint Spray Booths	Bldg. 250	Solvents, Petroleum
S17	A	Repair Shop, Spray Booths	Bldg. 251	Solvents, Petroleum
S18	A	Repair Shop, Cleaning Facility	Bldg. 252	Solvents, Petroleum
S19	A	Entomology Storage Area	NE of Sanitary WTP	Pesticides
S20	A	Base Photo Laboratory	Bldg. 336	Solvents, Metals, Silver

1. B = buried site
   P = open pond or ditch
   S = surface site
   T = underground tank
2. McClellan AFB has conducted preliminary investigations at this site.
   WTP = Waste Treatment Plant
   IWTP = Industrial Waste Treatment Plant

TABLE A-2. (Continued)

Site	Area	Description	Location	Potential Contaminants
821	A	Degreaser, Spray Booths	Bldg. 351	Solvents, Petroleum
822	A	Repair Shop, Spray Booths	Bldg. 355	Solvents, Petroleum
823	A	Old Plating Shop	Bldg. 358	Solvents, Metals, Cyanide
824	A	Depaint Washrack	Bldg. 375	Solvents, Petroleum
825	A	Transformer Repair Shop	Bldg. 440	PCB, Solvents, Petroleum
826	A	Maintenance Shop, Spray Booth	Bldg. 473	Solvents, Petroleum
827	A	Solvent Recovery Stills	Bldg. 478	Solvents
828	B	Oil and Paint Storage	Bldg. 615	OG
829	B	PCB Storage Area	Bldg. 655	PCB
830	B	Depaint Washrack	Bldg. 658	Solvents, Petroleum
831	Other	Aircraft Paint Hanger	Bldg. 692	Paints, Solvents, Petroleum
832	Other	Paint Storage Area	Bldg. 694	Paints, Solvents, Petroleum
833	Other	Hazardous Material Storage	Bldg. 788	Solvents, Other
834	B	Degreaser and Paint Spray Booth	Bldg. 852	Solvents, Other
835	B	Solvent Spray Booth	Bldg. 854	Solvents, Other
836	A	Oil Drum Storage	N of Bldg. 410	Solvents, Petroleum
837	A	Oil Drum Storage	N of Bldg. 410	Solvents, Petroleum
838	A	Drum Storage	N of Bldg. 431	Solvents
839	A	New Museum Site	W of 44th Street at Palm Street	Solvents
840	A	Troop Issue Site	—	Unknown
841	Other	Mat K Drainage	AE St. and Patrol Road	Petroleum, Solvents, Lead
842	A	Hobby Shop, MWR Wash Rack	—	Solvents, Petroleum
843	Other	Plane Wash Rack	—	Solvents, Petroleum
844	Other	Plane Maintenance	—	Solvents, Petroleum
845	Other	Plane Maintenance	—	Solvents, Petroleum
T6	B	500 Gal Underground Wash Solvent Tank	Bldg. 640	Solvents
T7	B	Solvent Pit & 500 Gal Waste Thinner Tank	Bldg. 640	Solvents
T8	Other	Contaminated Fuel Tank	Bldg. 758	Petroleum, Solvents
T10	A	Underground Solvent Tank	Bldg. 382	Solvents
T11	Other	Underground Storage Tank	Bldg. 1083	Solvents
T12	A	Under Waste Oil/Solvent Tank	Near Bldg. 342	Solvents
T15	A	Tank Farm	N of Bldg. 447	Solvents, Petroleum
T16	A	Tank Farm	NE of Bldg. 475	Solvents, Petroleum
T17	A	Tank Farm	S of Bldg. 350	Solvents, Petroleum
T18	A	Tank Farm	E of Bldg. 343	Solvents, Petroleum
T19	A	Tank Farm	E of Bldg. 344	Solvents, Petroleum
T20	A	Tank Farm	SW of Bldg. 475	Solvents, Petroleum
T21	A	Underground Solvent Tanks	W of Bldg. 342	Solvents, Petroleum
T30	A	Underground Solvent Tanks	S of Bldg. 252	Solvents
T31	Other	Underground Storage Tank	Near Bldg. 1028	Solvents
T32	Other	Underground Storage Tank	Near Bldg. 1023	Solvents
T33	Other	Underground Storage Tank	Near Bldg. 1021	Solvents
T36	A	500 Gal Underground Stoddard Solvent Tank	New Bldg. 380	Solvents
T37	A	500 Gal Underground Stoddard Solvent Tank	S of Bldg. 380	Solvents
T44	Other	Underground Stoddard Solvent Tank	NW of Bldg. 1048	Solvents
T45	Other	Oil/Water Seperator	N of Bldg. 711	Petroleum
T46	Other	Oil/Water Seperator	S of Bldg. 788	Petroleum
T47	A	Oil/Water Seperator	Near Sanitary Treatment Plant	Petroleum
T48	Other	Oil/Water Seperator	S of Bldg. 764	Petroleum

APPENDIX B

Site Safety Audit Checklist

HEALTH AND SAFETY PLAN AUDIT CHECKLIST

Project:

Key Personnel (Names and Companies):

Starting and Ending Dates:

	Yes	No	N/A	Comments
1. Daily Safety ("Tailgate") Meeting held?	[_]	[_]	[_]	
2. Attended by entire field crew?	[_]	[_]	[_]	
3. Are respirators available on-site for immediate use?	[_]	[_]	[_]	
4. Are respirators in proper working order and ready to use?	[_]	[_]	[_]	
5. Respirators stored in plastic bags in the Support Zone?	[_]	[_]	[_]	
6. Each employee has required personal protective equipment?	[_]	[_]	[_]	
7. Safety glasses worn?	[_]	[_]	[_]	
8. Gloves worn?	[_]	[_]	[_]	
9. Hardhats worn?	[_]	[_]	[_]	
10. Proper type of fire extinguisher available?	[_]	[_]	[_]	
11. Fire extinguisher inspected?	[_]	[_]	[_]	
12. Fire extinguisher in an accessible location?	[_]	[_]	[_]	
13. First aid kit properly stocked?	[_]	[_]	[_]	

HEALTH AND SAFETY PLAN AUDIT CHECKLIST (continued)

	Yes	No	N/A	Comments
14. First aid kit in an accessible location?	[_]	[_]	[_]	
15. Employee trained in first aid and CPR located at this site?	[_]	[_]	[_]	
16. Telephone available for emergency phone calls?	[_]	[_]	[_]	
17. Procedures established for maintaining contact with field teams working in isolated locations?	[_]	[_]	[_]	
18. Emergency phone numbers posted by the telephone or in an accessible location?	[_]	[_]	[_]	
19. Exclusion Zone established around work site?	[_]	[_]	[_]	
20. Unauthorized personnel prevented from entering the Exclusion Zone?	[_]	[_]	[_]	
21. Support Zone been established?	[_]	[_]	[_]	
22. Washing stations established in the Exclusion Zone for decontaminating safety equipment, and for hand washing?	[_]	[_]	[_]	
23. Trash cans available for disposal of gloves, paper towels, etc.?	[_]	[_]	[_]	
24. Barrels available for containerizing spent decontamination fluids?	[_]	[_]	[_]	
25. Safety equipment being decontaminated before leaving Exclusion Zone?	[_]	[_]	[_]	

HEALTH AND SAFETY PLAN AUDIT CHECKLIST (continued)

	Yes	No	N/A	Comments
26. Employees wash hands before leaving Exclusion Zone?	[_]	[_]	[_]	
27. Employees eat, drink, or smoke only in the Support Zone?	[_]	[_]	[_]	
28. Sufficient supply of drinking water located in the Support Zone?	[_]	[_]	[_]	
29. Support Zone located upwind and in an uncontaminated area?	[_]	[_]	[_]	
30. Bathroom facilities available?	[_]	[_]	[_]	
31. Shaded area available for taking breaks while working in hot environments?	[_]	[_]	[_]	
32. Appropriate direct-reading analyzer available for use?	[_]	[_]	[_]	
33. Field calibration checks of direct-reading analyzer being performed and documented?	[_]	[_]	[_]	
34. Direct-reading analyzer measurements are documented on the proper form?	[_]	[_]	[_]	
35. Appropriate types of detector tubes available for use?	[_]	[_]	[_]	
36. Detector tube bellows pump calibrated and leak-tested?	[_]	[_]	[_]	
37. Detector tube measurements are documented on the proper form?	[_]	[_]	[_]	
38. Appropriate personal monitoring devices being used?	[_]	[_]	[_]	

HEALTH AND SAFETY PLAN AUDIT CHECKLIST (continued)

	Yes	No	N/A	Comments
39. Personal monitoring samples being documented on the proper forms?	[_]	[_]	[_]	
40. On-site safety coordinator maintains a daily health and safety log?	[_]	[_]	[_]	
41. Deviations from the health and safety plan are documented?	[_]	[_]	[_]	

Recommended corrective measures for any items checked "No":

Project Safety Officer's Signature _____ Date _____

Distribution:

RADIAN
CORPORATION

ADDENDUM 1

Health and Safety Plan for
Monitoring Well Sampling

1.0 INTRODUCTION

The Department of Defense is currently involved in a program to clean up uncontrolled hazardous waste sites on military installations. McClellan Air Force Base (AFB) near Sacramento, California, is the site of an ongoing Remedial Investigation/Feasibility Study (RI/FS). At McClellan AFB, the RI/FS has concentrated on groundwater contaminated by hazardous chemicals. Currently, the groundwater on base is being sampled for a variety of contaminants as part of a long-term groundwater monitoring program.

This Health and Safety Plan describes the safety and health practices and procedures to be followed during groundwater sampling activities at McClellan AFB. All Radian field crews will follow this plan unless situations encountered in the field mandate plan modifications. Any variances to this Health and Safety Plan must be approved by the Project Director and the Project Safety Officer.

Monitor wells will be sampled using a manual bailing system and submersible pump or a dedicated positive displacement bladder pump. Purged groundwater will be pumped into a water trailer and then transported to the McClellan AFB Groundwater Treatment Plant for disposal.

The groundwater encountered during sampling activities at McClellan AFB may contain contaminants potentially hazardous to Radian field personnel. The key elements in prevention of worker exposure are the use of safe work practices and proper personal protection equipment, the maintenance of personal hygiene, and a working knowledge of the potential contaminants.

2.0 FIELD ACTIVITIES AND KEY PERSONNEL

This Health and Safety Plan addresses activities associated with groundwater sample collection, sample preparation and preservation, and sample packaging and handling.

These anticipated field activities include:

- Sample preparation and preservation;
- Field blank preparation;
- Collection of groundwater parameter data;
- Monitor well purging;
- Monitor well sampling; and
- Packaging and handling of groundwater samples.

Radian personnel primarily responsible for overseeing the safe operation of this project are:

- Project Manager - Morey Lewis
- Project Director - Ty Thompson
- Project Safety Officer - Rory W. Morgan

All Radian field team members will be ultimately responsible for executing daily work activities in a safe manner and in accordance with basic safety and health protocols outlined in this Health and Safety Plan.

Specific responsibilities of the field team members include:

- Reading and understanding this plan;
- Performing work safely;

- Reporting any unsafe conditions to their immediate supervisor; and

- Being aware of and alert for signs and symptoms of exposure to site contaminants and symptoms of potential over-exposure to the elements while working outdoors.

3.0 HAZARD ASSESSMENT

This section presents a hazard assessment of conditions and contaminants known or suspected to be present during groundwater sampling activities.

3.1 Chemical Hazards

A number of chemical contaminants have been detected in groundwater samples collected at or near McClellan AFB during the past few years. Compounds of particular interest include:

- 1,2-Dichloroethane;
- 1,1-Dichloroethene;
- 1,1,1-Trichloroethane;
- 1,1,2-Trichloroethene; and
- Vinyl chloride.

Physical, chemical and toxicological information relating to these contaminants assist in defining the hazards associated with their contact. Table 3-1 presents the physical properties of these five contaminants. In general, values listed in the table are for pure substances; mixtures of chemicals and dilution into groundwater may have a significant effect on the physical properties.

Due to their similarities in structure and composition, these substances produce similar health effects.

- Acute toxicity: Eye irritants.
  CNS depressant: confusion; dizziness; and nausea.

- Chronic toxicity: Injury to liver, kidneys and the adrenals.

TABLE 3-1. PHYSICAL PROPERTIES OF SELECTED INDICATOR CHEMICALS KNOWN TO BE PRESENT IN THE GROUNDWATER AT McCLELLAN AFB

Substance	Appearance	Density (@ 20°C)	Vapor Pressure (mm Hg)	Boiling Point (°C)	Water Solubility (g/100 ml @ 20°C)	Flash Point (°F)	Upper Explosive Limit (%)	Lower Explosive Limit (%)
1,2-Dichloroethane	Colorless liquid	1.26	87 @ 20°C	83-84	0.9	55.4	15.9	6.2
1,1-Dichloroethene	Colorless liquid	1.21	234 @ 25°C	31.6	0.0005	0	15.9	6.2
1,1,1-Trichloroethane	Colorless liquid	1.34	100 @ 20°C	74.1	Insoluble	None	90.	12.5
1,1,2-Trichloroethene	Colorless liquid	1.47	100 @ 32°C	86.7	0.1	None	90.	12.5
Vinyl Chloride	Colorless liquid	0.920 @ 15°	2600 @ 25°C	-14	Insoluble	-108	33	3.6

In addition to the chemicals potentially present in the groundwater, strong acids and bases are used by field personnel to preserve specific compounds in groundwater samples. These chemicals may cause skin irritation and/or serious burns.

3.2 Physical Hazards

Several physical hazards are associated with field preparation and groundwater sampling activities. These hazards include:

- Pressurized gas cylinders;
- Operation of motor vehicles in remote, off-road locales;
- Trailering a large volume water tank;
- Steam cleaning equipment;
- Refueling equipment; and
- Heat stress.

Workers performing strenuous activities during the summer months may encounter heat stress conditions. Heat stress monitoring will be implemented when ambient temperatures exceed 98°F.

4.0 SAFE WORK PRACTICES AND PERSONAL PROTECTION METHODS

Work activities associated with this groundwater sampling program will involve some potential physical and/or chemical risks to field personnel. The following sections address these potential risks and present work procedures and personal protective equipment required to safely perform the various work activities.

4.1 Field Preparation

Several work activities, such as the addition of acids and bases to sample containers and the preparation of field blank water, are performed in advance of field activities. The following sections present safe work practices for these activities.

4.1.1 Sample Container Preparation

Acids and bases are used to preserve the groundwater for three types of analyses -- U.S. EPA Method 602 (purgeable aromatics), U.S. EPA Method 200.7 (priority pollutant metals), and U.S. EPA Method 9010 (total and amenable cyanide). Hydrochloric and nitric acids are used to preserve samples for analysis by U.S. EPA Method 602 and U.S. EPA Method 200.7, respectively. A base, sodium hydroxide, is used to preserve samples to be analyzed U.S. EPA Method 9010. Small amounts of these acids and bases are added to the appropriate sample containers prior to initiating field activities. Liquid and vapor phases of these chemicals may cause severe burns. Extreme care will be used when handling these chemicals.

Personnel handling acids and/or bases are required to wear long pants, long-sleeved shirts, and closed-toe shoes (preferably leather). In addition, the following personal protective equipment must be worn: acid resistant vinyl or nitrile butyl rubber (NBR) gloves and chemical goggles or a protective face shield. All transfers will take place in a properly operational fume hood. In the event of a small spill, the spill area will be thoroughly flushed with water.

If the acid has splashed onto the clothes or skin of an employee, the employee will immediately take an emergency shower and strip off the clothes while in the shower. Exposed areas will be rinsed for at least 15 to 20 minutes to ensure that the chemical has been completely diluted.

Occasionally it is necessary to dilute concentrated stock solutions of acid. On these occasions, a protective splash apron will be worn in addition to the previously mentioned protective equipment. The dilution of acid with water creates an exothermic reaction which may generate a large amount of heat. To avoid excessive heat generation, small amounts of the acid will be added to a large volume of cool water. Small spills of concentrated acid will be neutralized with soda ash or sodium bicarbonate prior to flushing the area with water.

If a large spill of concentrated acid occurs, the individual will leave the area after advising others in the immediate vicinity of the spill. The area must be ventilated. The spill will be cleaned up only after a qualified health and safety professional has determined that the proper personal protective gear has been donned and that an appropriate cleanup plan has been identified. These spills usually can be neutralized with soda ash or lime.

For a complete description of the hazardous effects and proper handling procedures for each of these chemicals, each person handling these chemicals will read the applicable Material Safety Data Sheets in the laboratory, Building 1, at Radian's Sacramento office prior to the commencement of work in accordance with the employee training requirement specified in 29 CFR 1910.1200, Hazardous Communication Standard.

4.1.2 Field Blank Water Preparation

The preparation of field blank water involves boiling deionized water on a hot plate and subsequently bubbling an inert gas through the cooled

solution. Potential hazards arise when boiling water in Pyrex® containers and using compressed gases such as helium and nitrogen.

Boiling water will be supervised at all times to ensure that the container does not boil to dryness. Safety glasses with side shields and thermal protective gloves will be worn when handling the hot flasks.

Compressed gas cylinders will be securely chained at all times to prevent ccidental damage to the regulator head. When gas cylinders are not in use, main valves will be closed and any excess pressure to the regulator will be released. If the cylinder is not to be used for an extended period of time, the regulator will be emoved from the cylinder and the protective cover will be placed over the main valve.

Although helium and nitrogen are not flammable or explosive, they are simple asphyxiants and may cause asphyxiation if released into an enclosed area. When gas cylinders are not in use, main valves will be double-checked to ensure they are off. When the cylinders are in use, adequate ventilation will be provided to ensure sufficient oxygen replacement in the event of a system leak.

4.2 Field Activities

The following sections present safe work practices for the various field activities associated with sample collection.

4.2.1 Safety Equipment

All field personnel will wear steel-toed leather or rubber boots when conducting monitor well sampling. Polyvinyl chloride (PVC) or nitrile butyl rubber (NBR) gloves will be worn during the sampling process to protect personnel from contaminant exposure and to ensure sample integrity. Safety glasses with side shields will be worn while working around the compressor and

discharge line of the sampling apparatus during the purging of the wells. Hard hats will be worn when working around the "A" frame support structure.

All field personnel will be fit-tested with a half-face air purifying respirator prior to commencement of field activities. Organic vapor chemical cartridges will be used with the air purifying respirators. Respirators are not expected to be used routinely, but will be available for use if air monitoring results indicate the need (see Section 3.2.6). While respirators are not in use, they will be kept in clean plastic bags and carried in the sampling vehicle at all times.

Additional safety equipment, such as a first aid kit, fire extinguisher, portable emergency eye-wash station, fluorescent orange pylons, and audit checklist will be carried in the sampling vehicle at all times.

4.2.2 Approach to the Well

Many monitor wells are located in large remote fields. These fields are often overgrown with waist-high vegetation that may obscure numerous drainage ditches known to be present throughout many of the fields. When approaching wells under these conditions, one person will walk 30-50 feet ahead of the vehicle to check for drainage ditches and hidden debris.

During periods of moderate to heavy rain, the stability of the ground also will be checked to ensure adequate traction for the vehicles. If a vehicle should become stuck, the field crew will exercise extreme caution in any attempts to free it. If, after a few attempts, the vehicle is still stuck, additional help will be sought rather than jeopardizing worker safety, and McClellan AFB Environmental Management will be notified.

4.2.3 Equipment Operation

Field team use of numerous pieces of equipment creates some potential inherent physical hazards.

The water trailer adds considerable weight and length to the sampling vehicle, making the turning radius greater and stopping distance longer. Drivers will be aware of these conditions and exercise added caution when towing the trailer.

When backing a trailer, care will be taken to avoid jack-knifing the trailer. Backing will be done slowly with gradual direction corrections. Abrupt changes in direction at moderate speeds will cause the trailer to jack-knife.

Special care will be exercised when hitching and unhitching the water trailer. When backing the vehicle up to the water trailer, a second team member will stand off to the side and guide the driver. The director will never stand between the trailer and the moving vehicle. The vehicle's transmission will be placed in "PARK" and the parking brake firmly applied before hitching or unhitching the trailer.

Refueling equipment (generators and compressors) during the day often will be necessary. Engines will be allowed to cool three to five minutes before adding fuel. Care will be taken not to overfill gas tanks. If spillage should occur, the excess fuel will be wiped up before restarting the engine.

During steam cleaner operation, extra caution will be exercised to avoid possible serious burns. Safety glasses and protective gloves will be worn by all personnel involved with steam cleaner operations. Control of the steam jet will always be maintained and workers will avoid contact with the backspray. Workers also will be careful to avoid contact with the propane burner exhaust. The metal surfaces around the exhaust get extremely hot and can cause severe burns.

Portable electric generators will be operated with caution as they pose a hazard for potential electric shock. The generator will never be operated during wet conditions and workers' hands will be dry when using this piece of equipment.

4.2.4 Sample Handling and Collection

PVC or NBR gloves and safety glasses with side shields must be worn when filling sample containers and when handling equipment or sample containers that have come in contact with groundwater. Extra caution will be exercised when filling bottles containing preservatives (acids or bases). Skin contact with contaminated water or equipment will be avoided at all times. If a sampler contacts the water or equipment, the exposed area will be washed immediately. Clothing will be changed immediately if it becomes soaked with contaminated water. Sampler clothing should always be changed and cleaned at the end of each field day. Contaminated equipment will not be stored near food or personal gear.

Following sample collection, sample container lids will be snugly tightened to prevent leakage and the containers rinsed with clean water to ensure that the bottle surfaces are free of contaminated water. Containers will then be inserted into protective foam sleeves and placed in ice coolers to prevent breakage during transport.

4.2.5 Adverse Weather

Sudden inclement weather can encroach on unprepared samplers in the field. Field crew members will always carry the appropriate clothing for changeable weather. In severe weather conditions, the sample crews will leave the area and find shelter until the weather permits continued sampling or a decision is made to halt the sampling activities.

4.2.6 Air Monitoring Program

If the samplers detect odors at the well head, instantaneous air samples will be collected using direct reading Draeger® colorimetric indicator tubes. These indicator tubes will determine the presence of likely contaminants in the air space near the well. Contaminants to be monitored include:

1,1,1-trichloroethane, 1,1,2-trichloroethene, 1,1-dichloroethene, 1,2-dichloroethane and vinyl chloride. The air samples will be collected by drawing a known volume of air through a Draeger® tube and observing any colorimetric change indicating the presence of airborne contaminants. Readings will be taken at the well head and at breathing zone height in the area where the field team members are working. A log of the results of the detector tube observations will be made part of the permanent program file. The time, date, location, type of tube, any observed color change, and the name of the individual taking the reading will be recorded on a field data sheet. Airborne concentrations will be monitored every 5 minutes until a negative result is produced for each parameter. The results of these tests will determine the type of action to be taken.

The following criteria will be used to determine when respiratory protection is needed and when work operations will be halted:

Contaminant	Airborne Concentration[a] At Which Respiratory Protection Is Required	Airborne Concentration[b] At Which Work Operations Are to be Halted
1,1,1-Trichloroethane	350 ppm	3,500 ppm
1,1,2-Trichloroethene	50 ppm	500 ppm
1,1-Dichloroethene	5 ppm	50 ppm
1,2-Dichloroethane	10 ppm	100 ppm
Vinyl Chloride	1.0 ppm[c]	10 ppm

[a] These concentrations represent the Threshold Limit Value (TLV)® established by the American Conference of Governmental Industrial Hygienists (ACGIH).

[b] These concentrations represent ten times the TLV® value.

[c] This concentration represents the Permissible Exposure Limit (PEL) established by the Occupational Safety and Health Administration (OSHA), 29 CFR 1910.107.

When respiratory protection is required, workers shall don half-face air purifying respirators equipped with organic vapor cartridges. No action is required if detected concentrations are less than those referenced above.

When work operations are to be halted, all equipment will be turned off and workers will immediately leave the area and contact the Project Safety Officer and the McClellan AFB Environmental Management. Work will not to be resumed until the Project Safety Officer has determined that work area conditions are safe.

4.2.7 Heat Stress

During the summer, the field activities at McClellan AFB involve working in warm to hot temperatures, often over 100°F. When field team are working in these high temperatures, precautions need to be taken to avoid heat stress illnesses. Heat-related disorders can range from dizziness, nausea, and profuse sweating in early stages, to unconsciousness, brain damage, or even death in the late stages (see Section 6.2).

Heat stress can be prevented by establishing work-rest regimens and avoiding overexertion. Liquids should be replenished frequently throughout the day. Workers also should rest in the shade away from surfaces that radiate heat (metal or concrete) as often as possible so they may more effectively cool down during rest periods.

5.0 PERSONAL HYGIENE

Personal hygiene is the most effective way to control potential chemical exposure from skin absorption or accidental ingestion.

Some general rules to obey when working in the field include:

- Wash your hands and forearms with soap and water before eating, drinking, or smoking;
- Wash your hands before using the toilet; and
- Take a thorough shower at the end of the day.

6.0 EMERGENCY RESPONSE PLAN AND PHONE LIST

Emergency procedures listed in this plan are designed to give the field team instruction in handling medical emergencies.

6.1 Injuries

Medical problems that may occur on site need to be handled competently and quickly. Each field team member will be aware of the instructions and information given below. Each field team member must also know the location and contents of the first aid kit supplied to them.

- Become familiar with the emergency telephone numbers in Section 6.3 of this Addendum of the Air Force base, community ambulances, and medical facilities provided in the Emergency Phone List.

- Seek professional medical attention for personnel who are not breathing, bleeding severely, experiencing intense pain, or are unconscious. Each member of the site team will know how to call for an ambulance (on and off base).

- If you get anything in your eyes (chemicals or dust), flush them with water for 15 minutes.

- Do not remove objects that are stuck in the eye. Always seek medical attention for eye injuries.

- All burns (chemical or thermal) will be treated by running cold water over the affected are.

- Report all injuries to the Project Safety Officer and/or your supervisor.

- In case of any emergency, the McClellan AFB Environmental Management will be notified.

6.2 Heat Stress

All project personnel should be familiar with the signs and symptoms of heat stress, as follows:

- Heat Exhaustion - Dizziness, fatigue, copious perspiration, cool skin that is sometimes pale and clammy, and nausea; and

- Heat Stroke - Hot, dry, flushed skin; delirium, and coma (in some cases).

Heat stress can be prevented by resting frequently in a shaded area and consuming large quantities of fresh potable water. If symptoms of heat exhaustion are observed, the person will be required to rest in a shaded area and consume liquids. If symptoms are widespread or observed frequently, an appropriate work/rest regimen will be instituted. This may involve limiting the work period so that after one minute of rest, a person's heart rate (HR) does not exceed 110 beats per minute.

If the HR is higher than 110 beats per minute, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the HR is 110 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent. Resting HR should be determined prior to the start of on-site activities. For a healthy individual, the resting HR is usually 60 to 72 beats per minute.

If symptoms of heat stroke are observed, workers will seek medical attention immediately and contact the Project Safety Officer.

RADIAN CORPORATION

6.3 Emergency Phone List

HOSPITALS

- On Base (if life threatening) 115
  Out-Patient Clinic (Building #541)

- Off Base 965-2155
  Mercy-San Juan Hospital - Emergency Room
  6501 Coyle Avenue
  Carmichael, CA

FIRE

- On Base 117 or 643-6666
- Off Base 911

AMBULANCE

- On Base 115
- Off Base 911

POLICE

- On Base 112 or 643-2111
- Off Base 911

RADIAN SAFETY OFFICER

- Rory W. Morgan 362-5332 (office)
  722-9032 (home)

BASE SAFETY OFFICER

- Ron Gamber 643-6227

RADIAN
CORPORATION

ENVIRONMENTAL MANAGEMENT

- Jerry Robbins 643-1250
  Mario Ierardi
  Bud Hoda
  Paul Brunner
  Charlie Thorpe

SURGEON GENERAL BRANCH

- Beeper 328-2042